Assembly & User Guide
November 2012
V1.1

NIXIE TUBE CLOCK KIT

TABLE OF CONTENTS

1. Introduction 2
2. Tools & Equipment Required 4
3. List of Components 5
4. Preparing the RGB LED Light Pipes 8
5. Assembly of the PCB 11
6. Assembling the Nixie Tube Cells 18
7. First Clock Test 20
8. Mounting the RGB Tube Lighting Components 20
9. Mounting Single Color Tube LEDs 21
10. How to Operate the Clock 22
11. Configuring the RGB LED Tube Lights 25
12. Using a GPS Receiver 28
13. Circuit Diagrams 29
14. Case Assembly 32

ramsey

1. Introduction

1.1 What is Nixie QTC?

Nixie QTC takes a new path for Nixie Clocks for mid-sized solder-in tubes.
Learning from our past experiences of thousands of kits sold, we recognise a major customer concern and possibly the biggest drawback with solder-in tubes: They are soldered in!

Previously, a failed tube always meant a treacherous operation to delicately remove the tube whilst trying to preserve all traces intact. While this was certainly possible, It was never easy, and made it uncomfortable to give a Nixe Clock as a gift in case a tube ever failed. With Nixie QTC ('Quick Tube Change'), each tube is soldered only to its own mini 'tube cell' PCB. A tube can be changed in minutes with no danger to the main PCB. The small addition in cost is dwarfed by the huge advantage this gives. A single main board is capable of driving tens of different types of solder-in Nixie Tube. You can even completely change the tube type of your clock by installing new tube cells and tubes.

Software

But at such a major change in direction, we have also taken the opportunity to build on the solid software foundations of the predecessor 'Frank 2' format and add some truly useful and productive software features. As before, the main controller is the mighty PIC16F1936 running at 16Mhz. The code is programmed entirely in the 'C' programming language.

Drive Mode

The former K155ID1 / 74141 Nixie driver IC is now replaced by a modern HV5812 High Voltage Driver IC by Supertex. With 20 outputs, it is able to drive the six Nixie Tubes in a very comfortable and low noise 3X2 multiplex.

GPS Time Synchronisation

A radical new clock design deserves a new and exciting GPS receiver module for those that demand the best timekeeping. And, with a groundbreaking price for a GPS receiver, a fully featured Nixie Clock with GPS synchronisation is now within the price range of most buyers.

1.2 Features

- Hours, Minutes and Seconds display
- 12 or 24 hour modes
- Uses a Quartz Crystal Oscillator as the timebase
- Programmable leading zero blanking
- Date display in either DD.MM.YY or MM.DD.YY or YY.MM.DD format
- Programmable date display each minute
- Scrolling display of date or standard display
- Alarm, with programmable snooze period
- Optional DCF / WWVB / MSF / GPS synchronisation with status indicator LED
- Dedicated DST button to switch between DST and standard time
- Supercapacitor backup. Keeps time during short power outages
- Simple time setting using two buttons
- Programmable leading zero blanking
- Five programmable neon colon settings (Flashing AM/PM indication, illuminated

AM/ indication, both flashing, both on, both off)
- Seconds can be reset to zero to precisely the set time
- Programmable night mode - blanked or dimmed display to save tubes or prevent sleep disturbance
- Rear Indicator LEDs dim at night to prevent sleep disturbance
- Weekday aware 'Master Blank' function to turn off HV/ tubes on weekends or during working hours
- Separate modes for colon neons during night mode
- Standard or fading change of digits
- Standard, fading, or fading with scrollback display modes
- 'Slot Machine' Cathode poisoning prevention routine
- Programmable RGB tube lighting – select YOUR favourite colour palette
- 729 colours possible. Have a different colour or your choosing every hour, or auto-changing colours. Your choice
- Not AC frequency dependent – works in all countries
- All user preferences stored to non-volatile memory

1.3 SAFETY

DANGER: The clock pcb includes a switched-mode voltage booster circuit. This generates nominally 170 Volts DC. Assembly may only be undertaken by individuals who are suitably qualified and experienced in electronics assembly, and are familiar with safe procedures for working with high voltages. If in doubt, refer to a suitably qualified engineer before proceeding.

The voltages generated by this circuit can give a potentially LETHAL ELECTRIC SHOCK.

DISCLAIMER: This product is supplied as a kit of parts, intended only for suitably qualified electronic engineers, who are suitably qualified and experienced in electronics assembly, and are familiar with safe procedures for working with high voltages. The supplier, his agents or associates accept no liability for any damage, injury or death arising from the use of this kit of parts.

This is not a finished product, and the person assembling the kit is responsible for ensuring that the finished product complies with any applicable local regulations governing electrical equipment, e.g. UL, CE, VDE.

2. Tools and Equipment Required

2.1 Tools required to assemble the PCB.

The following tools will be required to assemble the PCB:

- Soldering iron with a small tip (1-2 mm).
- Wire cutters to trim the excess component leads after soldering. (TIP: A small pair of nail clippers works very well for this function).
- Wire strippers (TIP: A small pair of scissors is quite suitable).
- Multimeter for voltage tests and for identifying the resistors.
- For the RGB LED tube lighting, a small hot air gun will be needed to shrink the heat shrink tubing over the LEDs to form the light guides. A small hair dryer may work for this.

Materials you will need.

- Solder – lead / tin solder is highly recommended. USE LEAD/ TIN SOLDER!.
- Lead free solder, as now required to be used in commercial products in Europe, has a much higher melting point and can be very hard to work with.
- Desoldering wick (braid) can be useful if you accidentally create solder bridges between adjacent solder joints.

Other items you will need.
The clock kit comes with our AC121 power adapter, suitable for use in most outlets, but should you need a replacement for any reason, make sure it meets the following criteria:
Output 12V DC regulated, minimum power output capability of 500 mA
Output plug: 2.1mm pin, centre positive.

AC121

3. List of Components

3.1 Table of Components—Driver Board

Circuit Designation	Part Description
Resistors	
R1	4.7 KΩ ¼ Watt YELLOW, VIOLET, BLACK
R2	390 KΩ ¼ Watt ORANGE, WHITE, BLACK
R3	4.7 KΩ ¼ Watt
R4	390 KΩ ¼ Watt
R5	4.7 KΩ ¼ Watt
R6 - R11	270 Ω ¼ Watt RED, VIOLET, BLACK
R12 – R14	4.7 KΩ ¼ Watt
R15 – R17	390 KΩ ¼ Watt
R18 – R26	10 KΩ ¼ Watt BROWN, BLK, BLK
R27, R28	4.7 KΩ ¼ Watt
R29, R30	390 KΩ ¼ Watt
R31 – R36	270 Ω ¼ Watt (Optional)
Capacitors	
C1, C2	100nF Ceramic
C3	1uF, 250V, Electrolytic
C4	470uF, 16-25V, Electrolytic
C5	33pF Ceramic
C6	15pF Ceramic
C7	100nF Ceramic
C8	0.1F
C9, C10	100nF
Transistors	
Q1	IRFD220 MOSFET
Q2 – Q4	2N7000 MOSFET (Optional)
Q5 – Q7	MPSA42
Q8 – Q10	MPSA92
Q11 – Q13	MPSA42
Diodes	
D1 – D3	1N5819
D4	UF4004
D5	5mm Green LED
D6, D7	5mm Yellow LED
D8 – D13	RGB 6-pin LED (Optional)
ZD1	62V Zener diode

Integrated Circuits	
IC1	7805 5V voltage regulator
IC2	PIC16F1936 8-bit microcontroller
IC3	HV5812
Miscellaneous	
ALT	Not Installed
L1	100uH inductor
AM, PM	4mm wire ended neon lamp
ALARM, SET, ADJ, DST	Miniature push button
IC2 Socket	28 Way narrow IC socket for IC2
IC3 Socket	PLCC28 IC socket for IC3
J1	2.1mm PCB power socket
GPS / RFT	Surface mount 3.5mm jack socket
LS1	Piezo sounder
FUSE	500mA fuse
Insulation	Clear insulation for neons
NX1 – NX6	2X6 way 0.1" header plug
X1	32.768KHz watch crystal

3.2 Parts list / Packing Sheet – Driver Board

Part Description	Quantity
Resistors	
270 Ω ¼ Watt	6 ✓
4.7 KΩ ¼ Watt	8 ✓
10 KΩ ¼ Watt	9 ✓
390 KΩ ¼ Watt	7 ✓
Capacitors	
33pF, Ceramic	1 ✓
15pF, Ceramic	1 ✓
100nF, Ceramic	5 ✓
1uF, 250V, Electrolytic	1 ✓
470uF, 16-25V, Electrolytic	1 ✓
0.1F	1 ✓
Transistors	
IRFD220 MOSFET	1 ✓
MPSA42	6 ✓
MPSA92	3 ✓
Diodes	
1N5819	3 ✓
UF4004 fast recovery diode	1 ✓
5mm Green LED	1 ✓
5mm Yellow LED	2 ✓
62V Zener diode	1 ✓
Integrated Circuits	
7805 5V voltage regulator	1 ✓
PIC16F1936 8-bit microcontroller	1 ✓
HV5812	1 ✓
Miscellaneous	
100uH inductor	1 ✓
4mm wire ended neon lamp	2 ✓
Miniature push button	4 ✓
28 way narrow IC Socket for IC2	1 ✓
PLCC28 IC Socket for IC3	1 ✓
2.1mm PCB power socket	1 ✓
Surface mount 3.5mm jack socket	1 ✓
Piezo sounder	1 ✓
500mA fuse	1 ✓
Clear insulation for neons	1 ✓
2X6 way 0.1" header plug	6 ✓
32.768KHz watch crystal	1 ✓
AC121 Power Supply	1

3.3 Parts list / Packing Sheet – RGB LED Pack

The LED pack contains the extra components needed for the RGB tube underlighting:

Part Description	Quantity
270 Ω ¼ Watt resistor	6
6 Pin RGB LED	6
2N7000 MOSFET	3
8cm white 10mm heat shrink	1
8cm black 10mm heat shrink	1

3.4 Parts list / Packing Sheet – Tube Cells

The tube cells contain the mini PCB for mounting the tube, and the 0.1" connectors. For each tube, there is 1 PCB and either:

1 X 6X2 socket
or
2 X 6X1 socket

It is recommended that the kit is checked against the list above, to ensure all parts are present before commencing assembly. Don't be alarmed if there are some extra components, as some component bags are shared between different kit types.

The resistors used in the kit are 1% tolerance metal film. They are marked with 4 coloured bands to identify the value. However it is sometimes unclear in which direction the bands should be read. Therefore, we recommend that the resistors be identified with a multimeter.

Please note the fuse will look like the picture below. It can easily be confused for a capacitor. It is a self-resetting fuse.

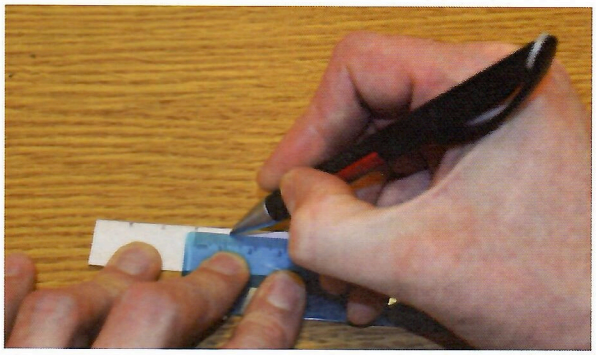
4. Preparing the RGB LED Light Pipes

If you are not using the RGB LEDs you should omit this step.

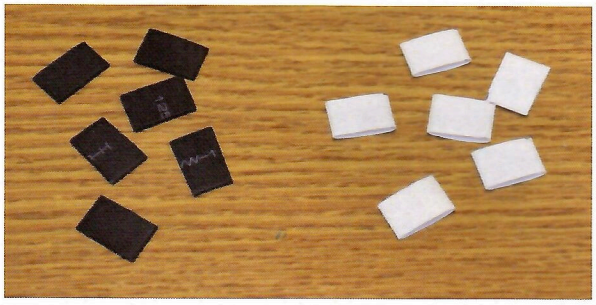
A white then black heat shrink tube is attached to each LED to form a 'light pipe' to concentrate the light at the bases of the Nixie Tubes.

4.1 Cut the heatshrink tubing to 11mm lengths

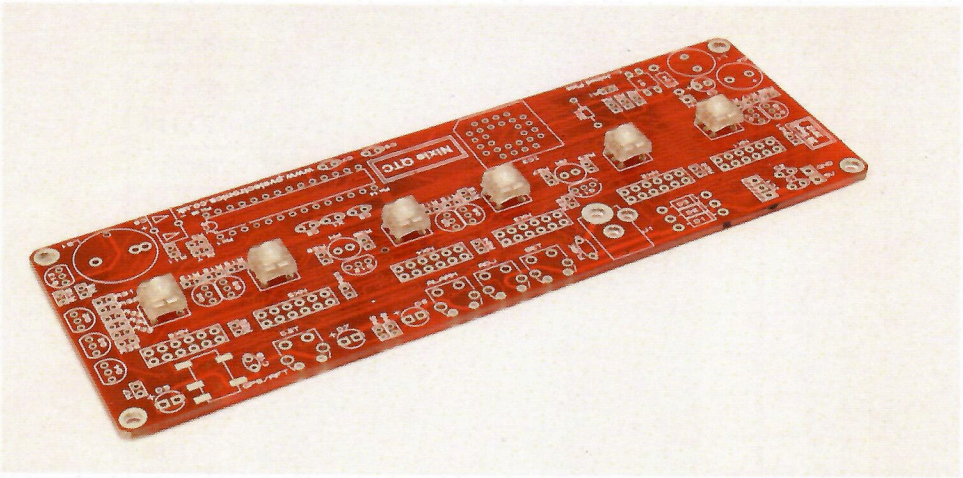
Using a ruler and a pen, mark the black and white tubing at 11mm intervals.



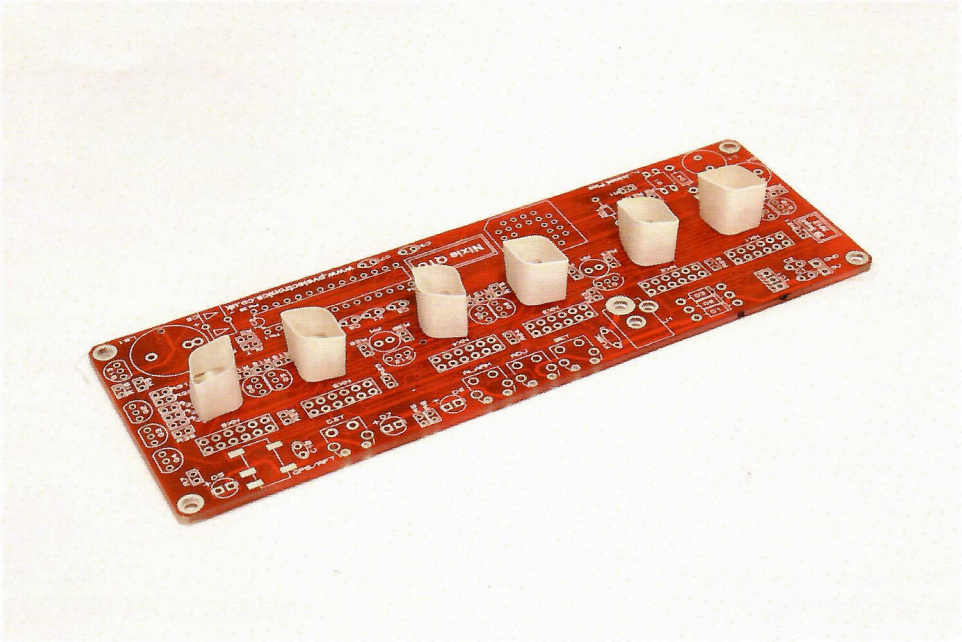
Then cut with scissors to make 6 white and 6 black pieces:



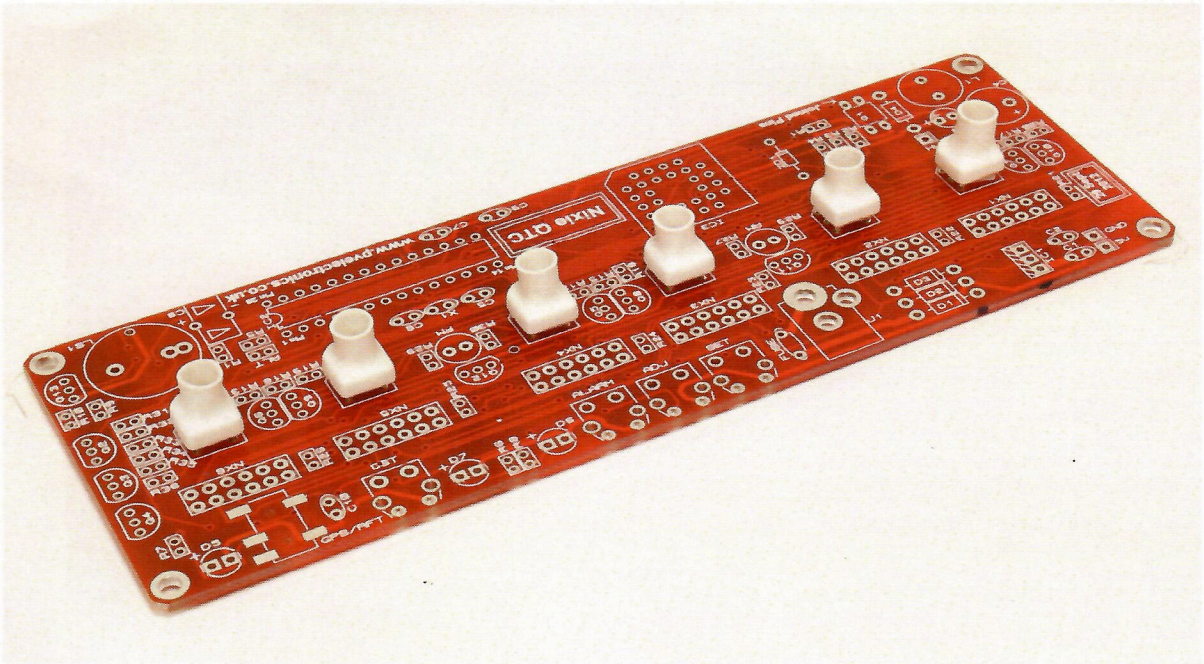
4.2 Place the 6 RGB LEDs in their locations in PCB, BUT DO NOT SOLDER.



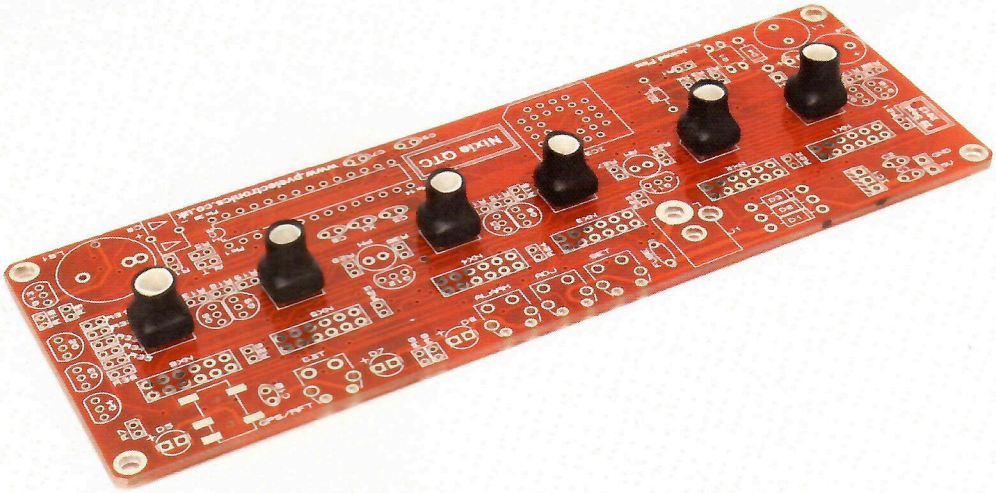
4.3 Place a piece of white tubing over each LED so it is touching the PCB.



4.4 Using the hot air gun or hairdryer, GENTLY shrink the tubing over the LEDs Us low heat setting and keep the gun far from the PCB and keep moving. Rotate the PCB to shrink the back of the tubing as well. Then let the PCB cool for 2 minutes at is will be quite warm. It should now look like this:



4.5 Repeat with the black tubing:



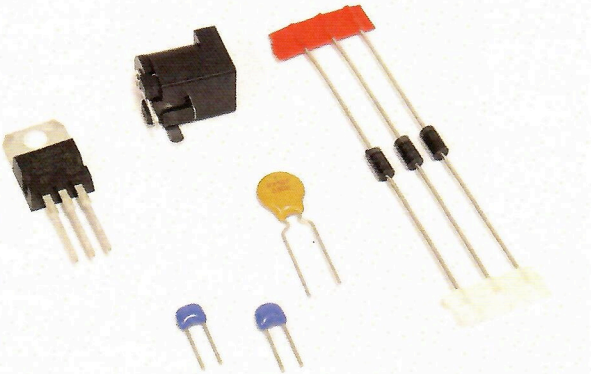
4.6 Finally, remove the six LEDs and put to aside for later in the assembly.

5. Assembly of the PCB

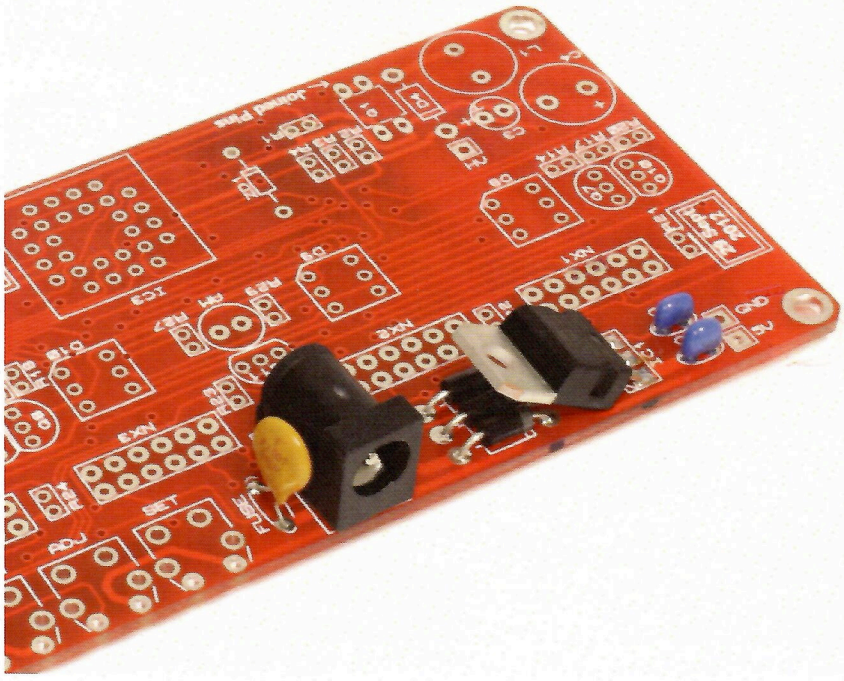
NOTE: DUE TO PRODUCT DEVELOPMENT AND IMPROVEMENTS, YOUR PCB MAY NOT LOOK EXACTLY LIKE THE ONE PICTURED.

5.1 Low Voltage Power Components

J1, FUSE
D1-D3 (1N5819)
IC1 (7805)
C1, C2 (100nF, marked as 104)

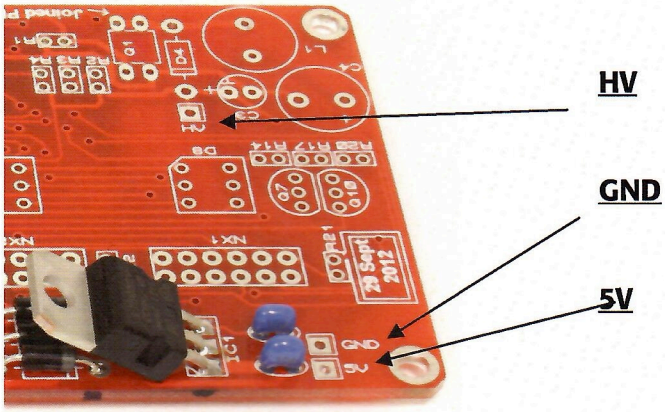


Start by installing D1-D3. Align the white band on the components with the band marked on the PCB. After placement, IC1 can be placed and bent over these diodes to reduce the height of the assembled PCB. Continue to mount C1, C2, J1 and FUSE.



5.2 Testing Low Voltage Power Supply.

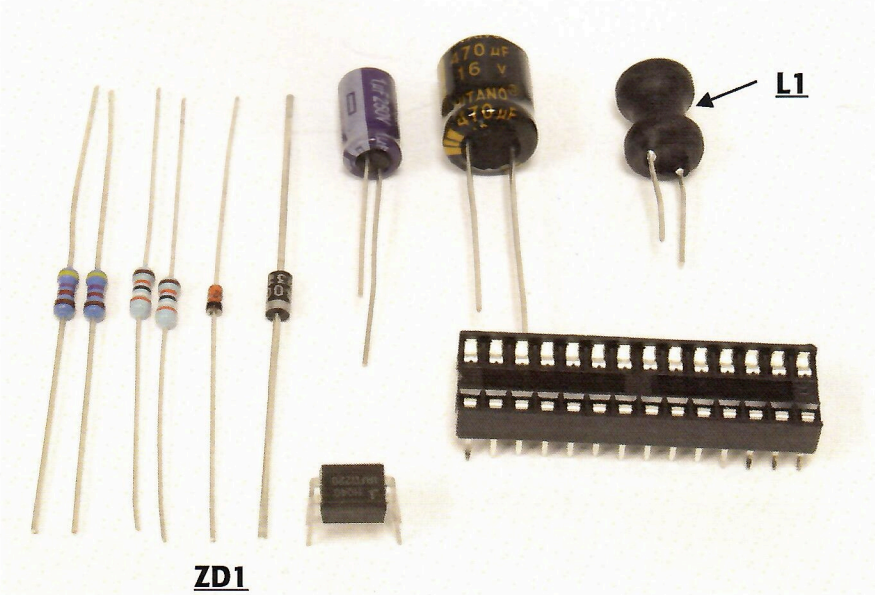
Identify the test GND, 5V and HV test points as shown below.



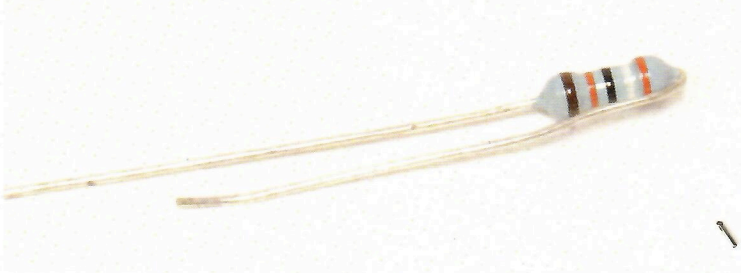
Plug in the power supply, and then test using a DC voltmeter: Touch the black probe on the GND test point and the red probe on the 5V test point. The voltage should measure between 5.1 and 5.3 Volts. If not, disconnect power and check your work. Do not proceed with the assembly until the error is corrected. Once the test is completed, disconnect the power.

5.3 High Voltage Generator components.

Socket for IC2
R1, R3 (4.7 KΩ yellow-purple-red-brown)
R2, R4 (390 KΩ orange-white-black-orange-brown)
C3 (1uF)
C4 (470uF)
Q1 (IRFD220)
L1 (100uH Inductor)
D4 (UF4004)
ZD1 (62V Zener diode)

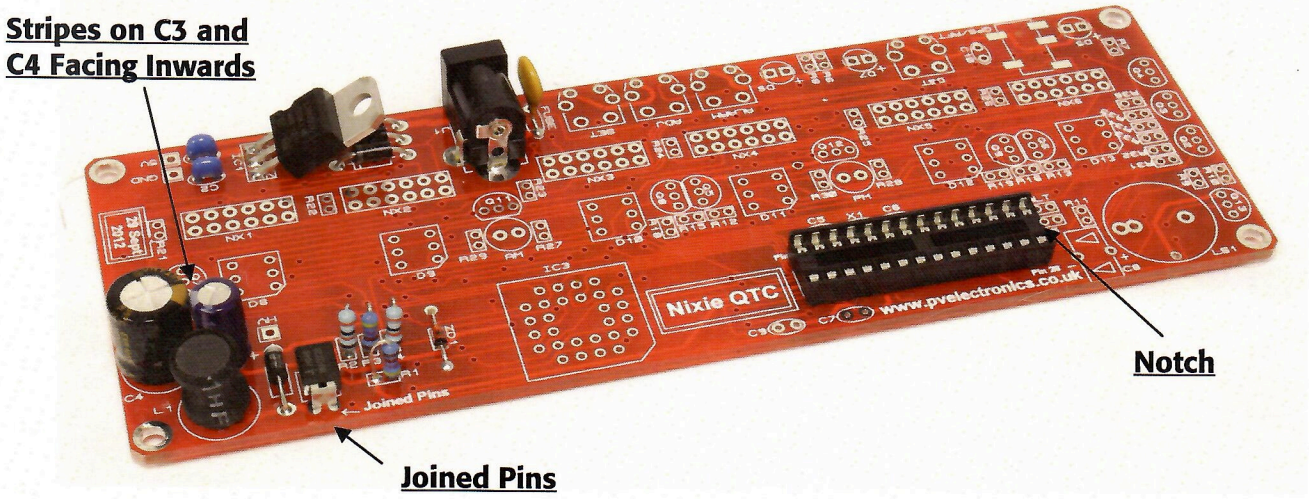


All the resistors on the board need to be mounted upright to save space. The leads need to be formed as shown below. Bend the leads of each resistor as shown and solder in to the correct position, making sure the component body is as close to the board as possible.



Take care that the notched end of the IC socket is at the end shown. Also the MOSFET needs to be placed with the two joined pins at the position shown below.

Ensure that the (-) light stripes on C3 and C4 are facing inwards towards each other as shown below.

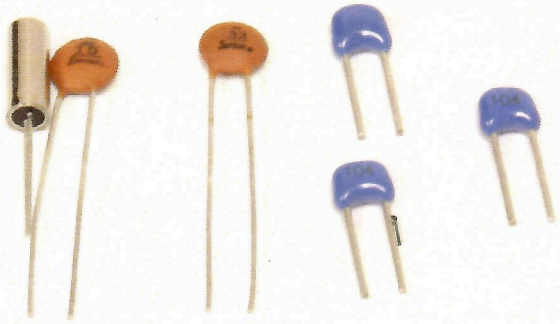


5.4 High Voltage Generator Test.

1. Refer to the warnings on page 5
2. Insert IC2 into its socket. Orient the notch on the IC with the notch on the IC socket and the PCB marking.
3. Power up the PCB, and using the GND and HV test points, measure the high voltage generated. It should be between 167 and 173. If this is in order, disconnect the power supply. Finally, remove IC2 from its socket and replace on its static-protective foam. It is best kept safe until needed for the tube tests later in the assembly.

5.5 Install the following:

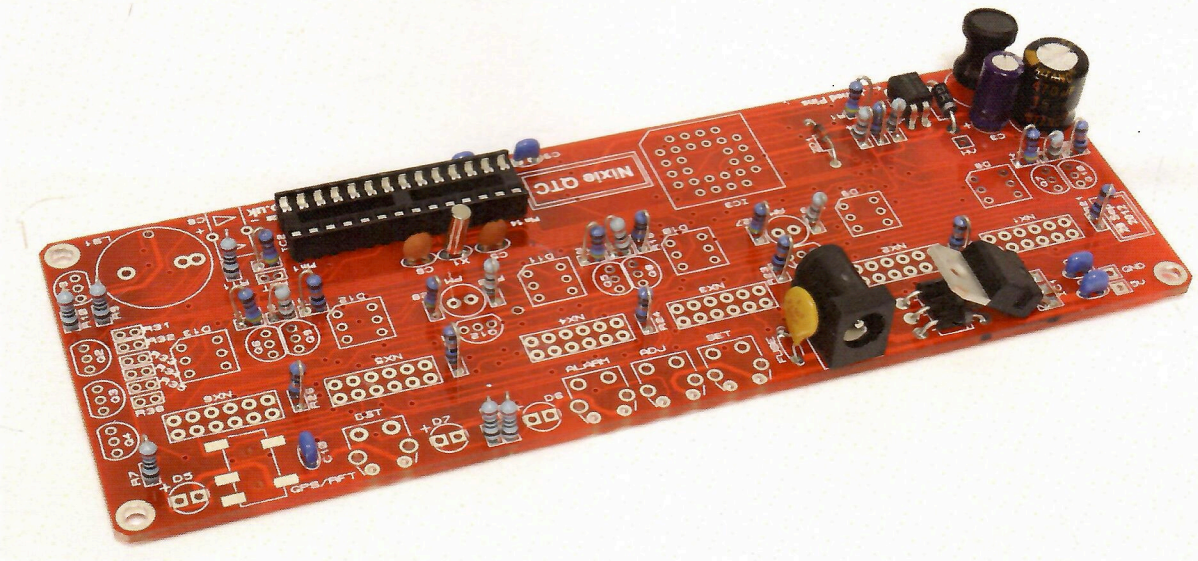
C5 (33pF)
C6 (15pF)
X1 (32.768KHz Crystal)
C7, C9, C10 (100nF, marked 104)



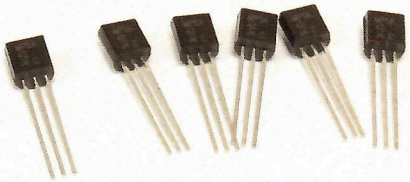
5.6 Install the Following:

R6 - R11 (270 Ω red-purple-black-black-brown)
R5, R12, R13, R14, R27, R28 (4.7 KΩ yellow-purple-red-brown)
R15 - R17, R29, R30 (390 KΩ orange-white-black-orange-brown)
R18 - R26 (10 KΩ brown-black-orange-brown)

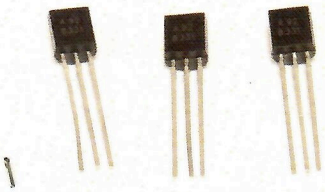
Note that if your PCB has a part marked 'ALT', this is not installed.



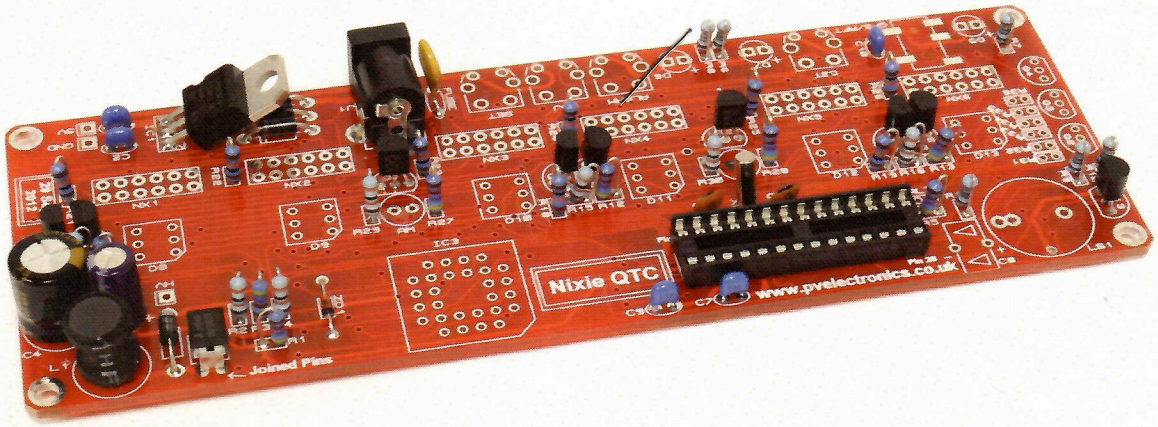
5.7 Install Q5, Q6, Q7, Q11, Q12, Q13 (MPSA42)



5.8 Install Q8, Q9, Q10 (MPSA92)

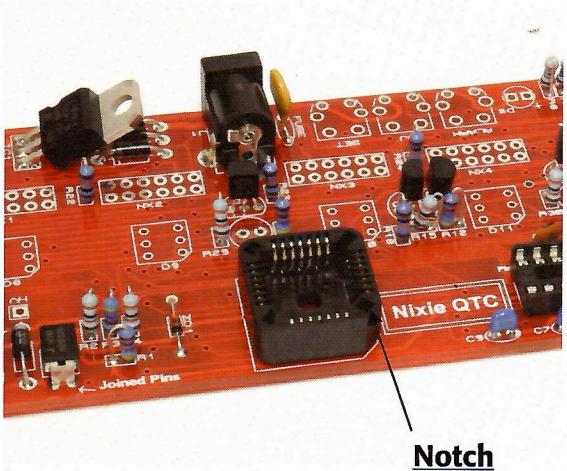


This is how the PCB should look now:

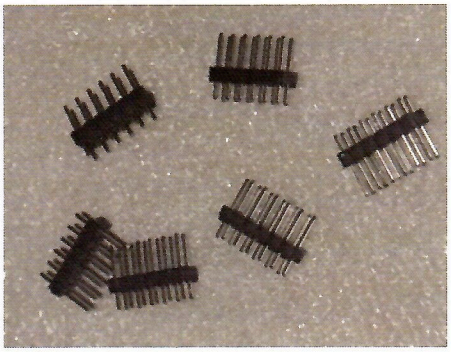


5.9 Install Socket for IC3

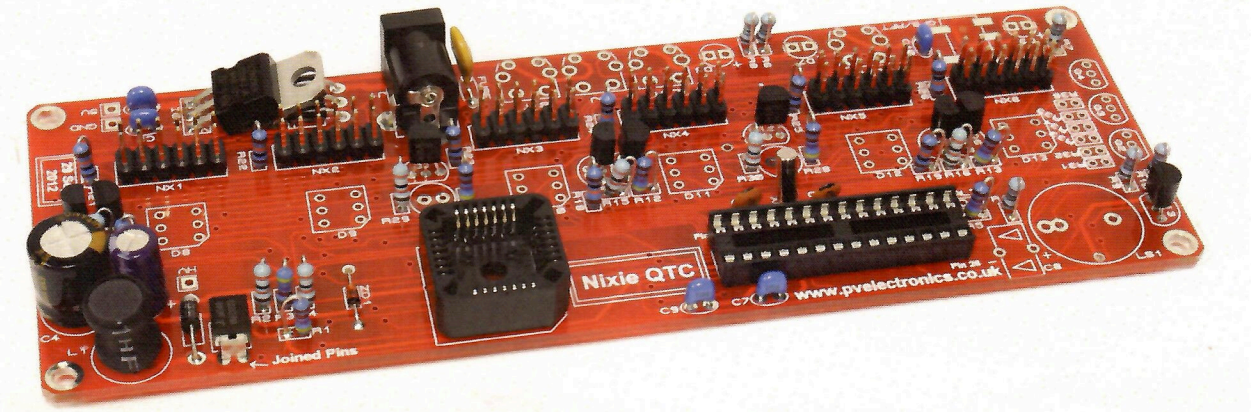
Align the notch on one corner of the socket with the marking on the PCB. Be careful not to force in the socket if all pins are not aligned. Ensure all pins are fully pushed through the holes before soldering in place.



5.10 Install NX1 – NX6 (6X2 way male pin header)

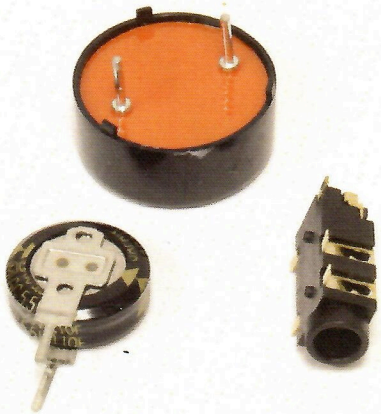


The connectors are intentionally a tight fit so that they will stay in place when you invert the PCB to solder them in. If necessary, use a hard flat object to push them into place.



5.11 Install the Following:

GPS/ RFT Connector
LS1 (Piezo Buzzer)
C8 (0.1F)

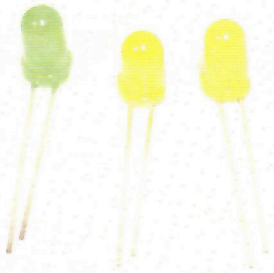


To solder the GPS / RFT connector: First wet one pad on the PCB with solder. Then place the connector in position and re-touch the pad with the soldering iron. This will anchor the component and then you can solder the remaining pads.

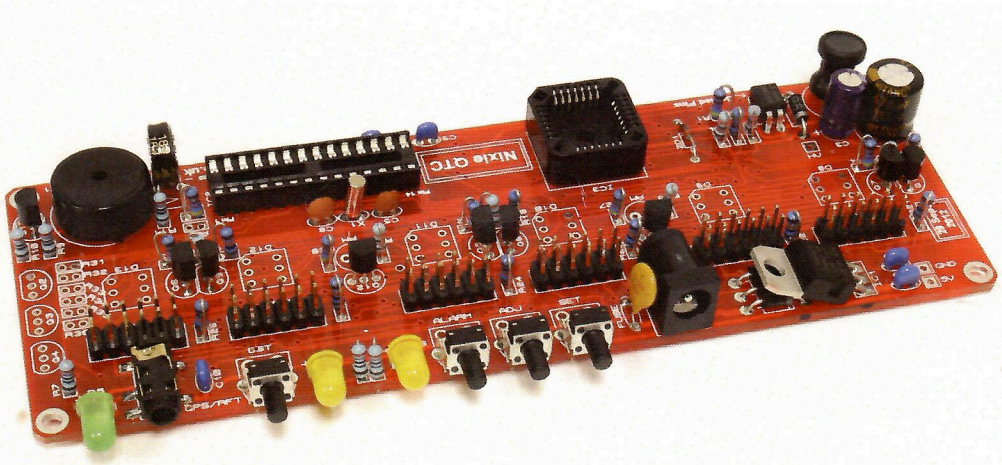
5.12 Install the Following:

D5 (5mm Green LED)
D6, D7 (5mm Yellow LED)
SET, ADJ, ALARM, DST (Push switches)

First, bend the leads of the LEDs as shown below, paying attention to the longer (+) lead being on the left hand side. Then solder in place with the body of the LED just touching the PCB.



Then place and solder the 4 push button switches:



5.13 AM, PM Neon Indicators

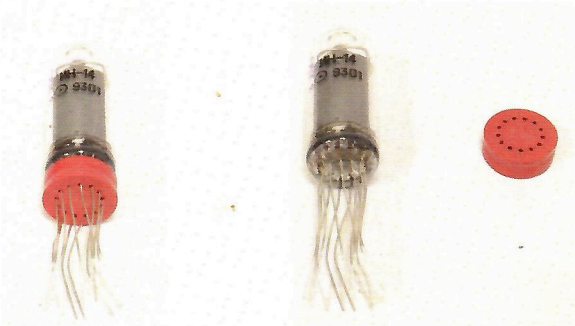
It is a good idea to install these components at the very end of the assembly, when you have a better idea of a suitable height that will look perfect with your design of case. So, do not install them now but remember to install them some time later! Use small pieces of the clear insulation supplied to prevent shorts on the leads.

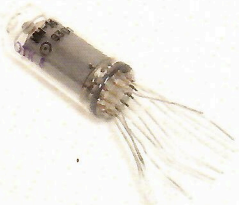
6. Assembling the Nixie Tube Cells

PLEASE REFER TO THE APPROPRIATE SECTION FOR YOUR NIXIE TUBE TYPE.

6.1 IN-14 Nixie Tubes

Remove the red base from the tubes:





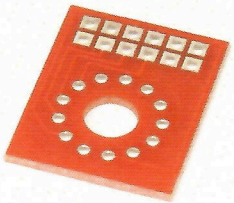
Untrimmed

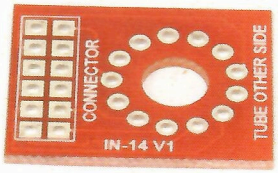
To facilitate easy insertion of the flying leads into the small holes, it helps enormously to trim the flying leads with a pair of scissors as shown below. Start by identifying the anode lead at the back of the tube. It has a white coating where it enters the glass.

Trimmed

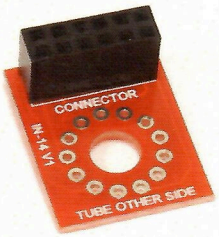
Then, working around the tube, cut each successive lead approx 2mm shorter than the previous one. This will allow you to feed each lead in in turn.

Referring to the pictures below, identify the anode pad on the tube cell PCB. The tube is inserted from the side with no white markings:



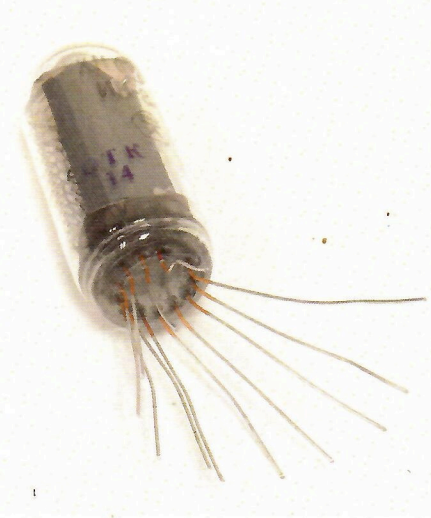


Then solder on the black connector (which may be in two pieces) and trim the leads on the bottom. Now you can insert and solder in the tube. Pay attention that the tube sits squarely on the PCB.



The tube cell is now complete. Repeat for the other 5 tubes, then move on to **section 7.**

6.2 IN-8-2 Nixie Tubes

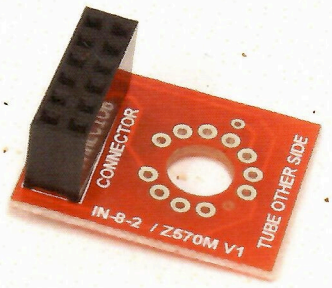


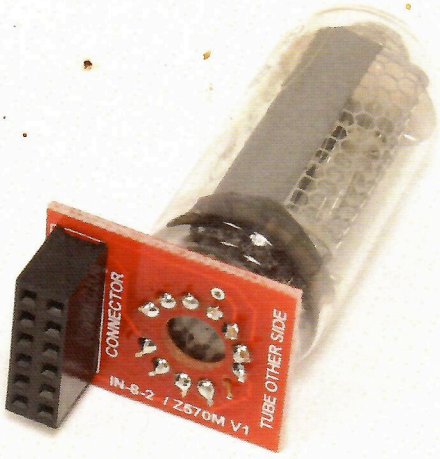
To facilitate easy insertion of the flying leads into the small holes, it helps enormously to trim the flying leads with a pair of scissors as shown below. Start at one of the leads at the back of the tube.

Then, working around the tube, cut each successive lead approx 2mm shorter than the previous one. This will allow you to feed each lead in in turn.

Now you can insert and solder in the tube. Insert the 12 leads into the 12 holes. Insert from the side of the PCB with no markings.
Pay attention that the tube sits squarely on the PCB.
Note that there is one hole that is unused - simply trim off this lead without soldering.

Then solder on the black connector (which may be in two pieces) and trim the leads on the bottom. Now you can insert and solder in the tube. Pay attention that the tube sits squarely on the PCB.





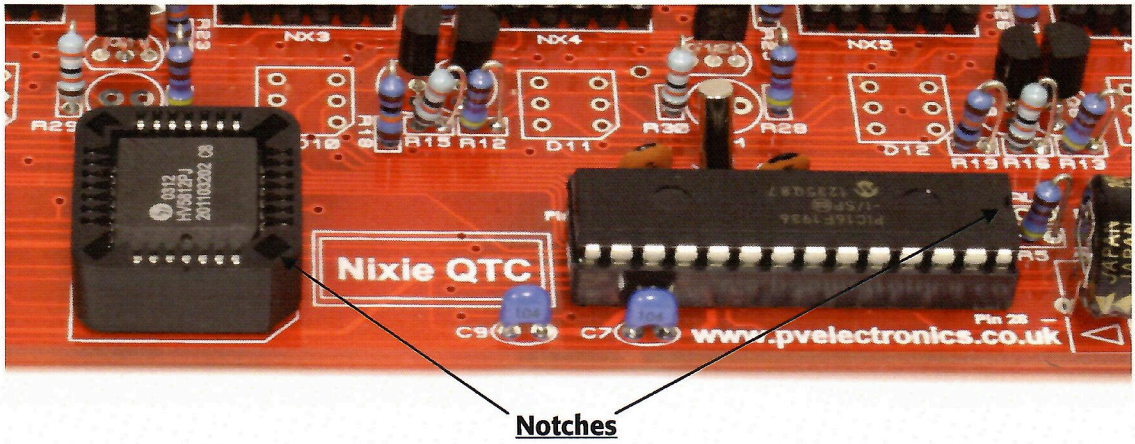
The tube cell is now complete. Repeat for the other 5 tubes, Then move on to **section 7**.

7. First Clock Test

It is now time to check the basic clock functions and that all tubes are working correctly.

7.1 FIRST TEST

Insert IC2 and IC3 into their sockets, with the notches aligned as shown below:



Insert the 6 tube cells into the main PCB, ensuring the tubes face forwards (The switches are at the back).

Connect a 12V DC power supply (2.1mm central pin type, centre positive) and power up.

The clock should start counting 0-9 repeatedly on all tubes. If this does not happen, power off and check all tubes are connected correctly.

Pressing 'SET' will exit the tube test mode and the clock will start time display.

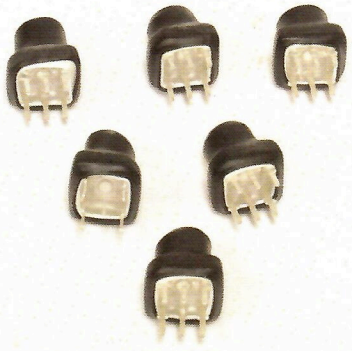
Do not be tempted to press buttons without knowing the function. If the clock bleeps, shows the time and is incrementing time, this is sufficient at this stage. Power off and disconnect the power supply.

8. Mounting the RGB Tube Lighting Components

Complete step 8 if you wish to install the included RGB Tube Lighting Pack. Alternatively, you may choose to install a single colour LED (Step 9), or no LEDs at all.

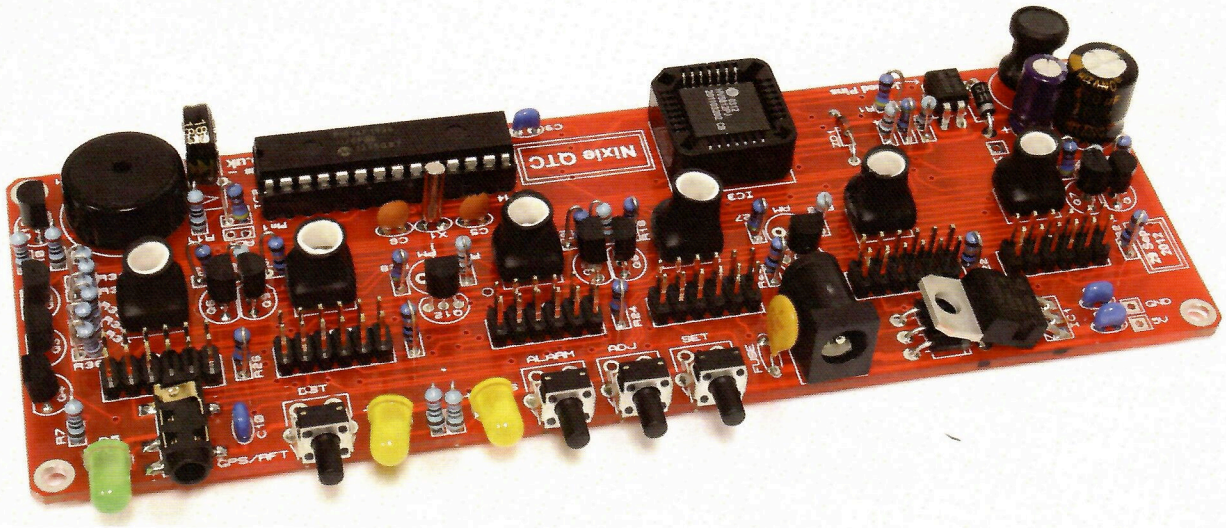
8.1 Locate the following:

RGB LEDs D8 – D13.
Q2 – Q4 (2N7000)
R31 – R36 (270 Ω)



Retrieve the 6 LEDs from earlier, complete with light pipes:

Install an LED at each LED location, looking carefully for the 'notched' corner on each LED which is partially masked by the heat shrink, but still visible. This aligns with a corresponding PCB mark . Solder in each LED and then the other components of this step:

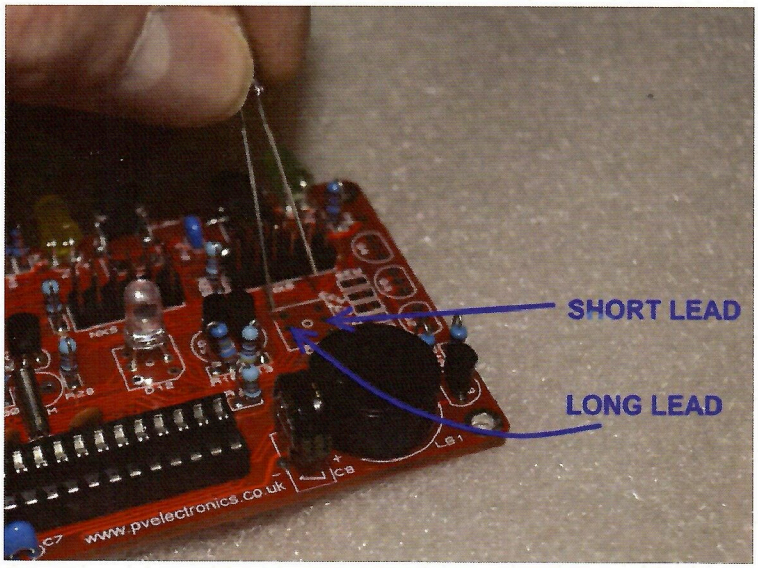


9. Mounting Single Color Tube LEDs

Complete step 9 if you wish to use a single standard LED per tube location. Note that the components for this step are not supplied. The information is supplied for guidance only.

It is suggested to install each single LED across the central of the RGB pin pairs. This corresponds to the Green LED channel in the software settings. You will use the Green values to set the LED brightness (regardless of the actual color of the LEDs installed)

The circuit uses 2 X (3 LEDs in series), driven from 12V. The current limiting resistors for the Green channel are R33 and R34. Calculate the value of the resistors needed and ensure the power rating of the resistor is suitable for the current that will be flowing. A 2N7000 MOSFET transistor will need to be installed at the Q3 position to drive the LEDs in software on the Green channel.



10. How to Operate the Clock

The four buttons have the following functions:

SET: Exit tube test routine on cold power-up;
Show date;
Set time and date;
Enter configuration menu;

ADJ: Adjust: time, date, alarm time, configuration parameters;

ALARM: Set alarm time; snooze; cancel snooze/alarm;

DST: Toggle between DST and Standard Time (+/- 1 Hour)
Enter colour setup menu; scroll through colour / time options

Entering configuration mode:

The principal settings of the clock are stored in flash memory – your preferred configuration is stored even after powering off the clock for extended periods. To access the configuration mode press and hold the 'SET' button. After 2 seconds the seconds will become highlighted. Continue holding the button a further 2 seconds until the clock displays in this format: 00-XX-99. The '99' in the seconds digits tells you that you are in the configuration menu.

In configuration mode the hours digits diplay the current parameter being adjusted, and the minutes digits display the current value stored against the parameter.
For each parameter, and referring to the following table , scroll through the range of possible values by pressing the 'ADJ' button. When the desired value has been reached, move on to the next parameter by pressing the 'SET' button. When the last parameter has been set, pressing 'SET' one more time will revert the clock back to time display mode. The first parameter (0) cannot be changed as it is the software revision number. It will show for several seconds and then move to parameter 1.

In all correspondence on support issues, please quote the board type, revision date and software version.

Parameter	Description	Values
0	Software revision	10 = version 1.0, 11 = version 1.1 etc
1	12 / 24 Hr mode	0 – 12 Hr (default) 1 – 24 Hr
2	Date format	0 = MM.DD.YY (default) 1 = DD.MM.YY 2 = YY.MM.DD (from V1.1 onwards)
3	Leading zero blanking eg. *0*1:54:32	0 – leading zero blanked (default) 1 – leading zero displayed
4	Night Mode start hour	0 - 23
5	Night Mode end hour	0 - 23
6	Night Mode	0 – Tubes off 1 – Dimmed display (default)
7	Master Blank start hour[1]	0 - 23
8	Master Blank end hour[1]	0 - 23

9	Master Blank days[1]	0 – Off 1 – Weekdays 2 - Weekends 3 – All days (default)
10	Colon neons mode	0 – AM/PM Indication, flashing 1 – AM/PM Indication, illuminated 2 – Both flash (default) 3 – Both illuminated 4 – Both off
11	Colon neons during night dimmed mode [2]	0 – AM/PM Indication, flashing 1 – AM/PM Indication, illuminated 2 – Both flash 3 – Both illuminated (default) 4 – Both off
12	GPS Enable	0 – GPS Disabled (default)[3] 1 – GPS Enabled
13	GPS Baud rate	0 – 4.8 Kbps (default) 1 – 9.6 Kbps 2 – 19.2 Kbps 3 – 38.4 Kbps
14	GPS time offset hours	0-13 (default 0)[4]
15	GPS time offset mins	0-45 (default 0)[4]
16	GPS time offset polarity	0 - Minus time (default) 1 – Plus time
17	Night Mode Override Period	0 – 50 (default 0 gives 15 seconds over-ride)[5]
18	Snooze period	0 – 6 minutes (default) 1 – 9 minutes 2 – 12 minutes 3 – 15 minutes
19	Auto date display each minute	0 – Off 1 – On (default)[6]
20	Reserved – leave as 0	0
21	Reserved – leave as 0	0
22	Slots Mode[7]	0 – Slots disabled 1 – Slots every minute 2 - Slots every 10 minutes (default) 3 - Slots every hour 4 – Slots at midnight
23	Display Mode	0 – standard change of digits 1 – fading digits 2 – fading digits with scrollback effect (default)
24	Restore default settings	0 – Keep user settings 1 – Restore original default settings[8]

Notes:

1. Master Blanking Mode has priority over Night Mode. Use to disable the clock on week-ends (eg clock is in office), or during office hours (eg clock is at home). Complete HV shutdown to save power and tube life.
2. Night time neons mode is active when night mode is set to dim. During night time blanking the tubes AND neons are disabled.
3. Clock is fully functional without GPS synchronisation. Set time manually.
4. Enter your time zone offset from UTC.
5. Press 'SET' briefly during Night Mode to show time for prescribed period.
6. Date will be displayed each minute between 50 and 55 seconds past the minute.
7. Visual effect / cathode poisoning prevention – all digits on all tubes are cycled for 10 seconds. This setting overrides night blanking or dimming for the duration of the effect (10 seconds).
8. Set this parameter to '1' to restore original default settings. Internal operations will then load all the original settings and restore the value to '0'

Setting the Time and Date:

From time display mode, press and hold 'SET' button for 2 seconds until the seconds digits are highlighted.
Press the 'ADJ' button to reset seconds to zero.

Briefly Press 'SET' again and the hours will be highlighted
Press the 'ADJ' button to set the minutes.

Briefly Press 'SET' again and the hours will be highlighted.
Press the 'ADJ' button to set the hours.

Proceed in this fashion to set the calendar: Year, Month and Day.

Finally, briefly Press 'SET' again to revert to normal clock operation.

Showing Date:

From time display mode, briefly press 'SET' button. Date will be shown for 5 seconds, then revert to time display.

Auto Date Display:

Setting parameter (19) to '1' will enable auto display of date between 50 and 55 seconds past each minute.

Night Blanking Override:

During programmed night blanking, the blanking may be overridden to see the time by briefly pressing the 'SET' button. Tubes will remain lit for the period defined in parameter (17).

Setting Alarm:
Press the 'ALARM' Button. The seconds digits show the on / off status of the alarm: 00 or 01 (off or on).

Set on / off status, then minutes followed by hours by using the 'ALARM' and 'ADJ' buttons. When set, the alarm LED will also light.

Cancelling Alarm:
Press 'ALARM' briefly to cancel alarm and enter snooze mode, or a longer press until the clock bleeps, to cancel snooze. Alarm remains set for the next day.

Rapid DST Adjustment
Press 'DST' briefly to toggle between DST and standard time. The Indicator shows whether DST mode is active or not. Note, that GPS time data does not contain DST information, so the DST status will need to be set manually in GPS sync mode as well as manual time-set mode.

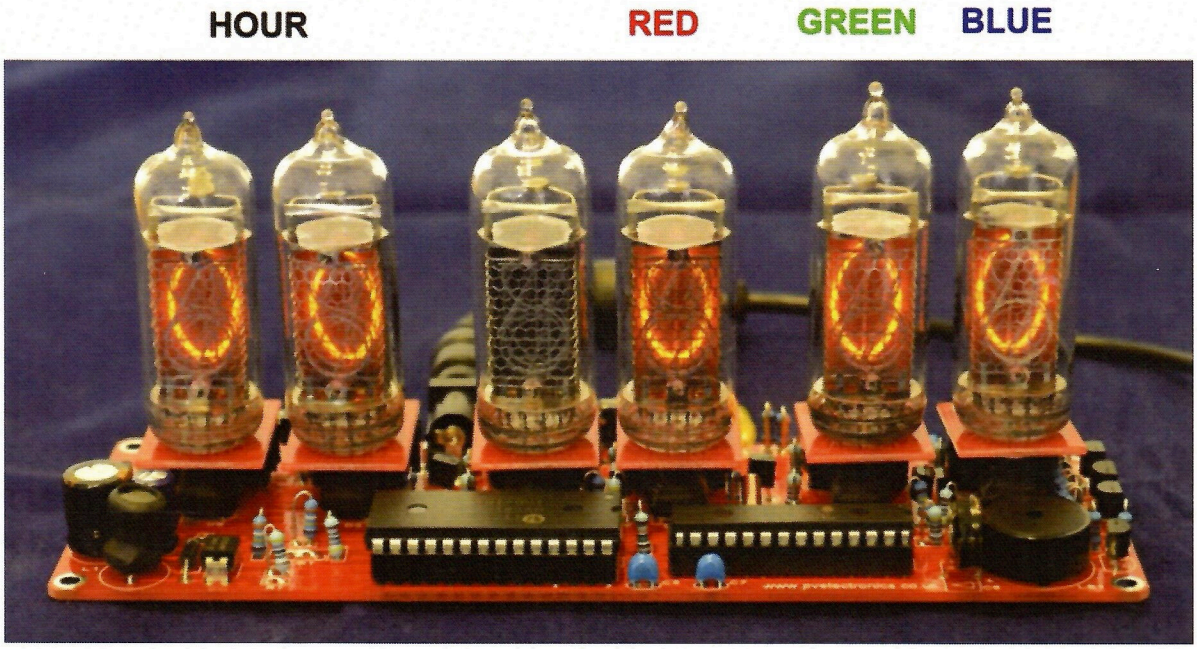
11. Configuring the RGB LED Tube Lights

The clock features a separate and dedicated setup menu for the RGB LED lights, accessed from the 'DST' button. All settings are stored to non-volatile memory, so your favourite colours will still be there after even a long power off.

You can set fixed colours and intensities, or program an auto colour cycling effect at your choice of speed.

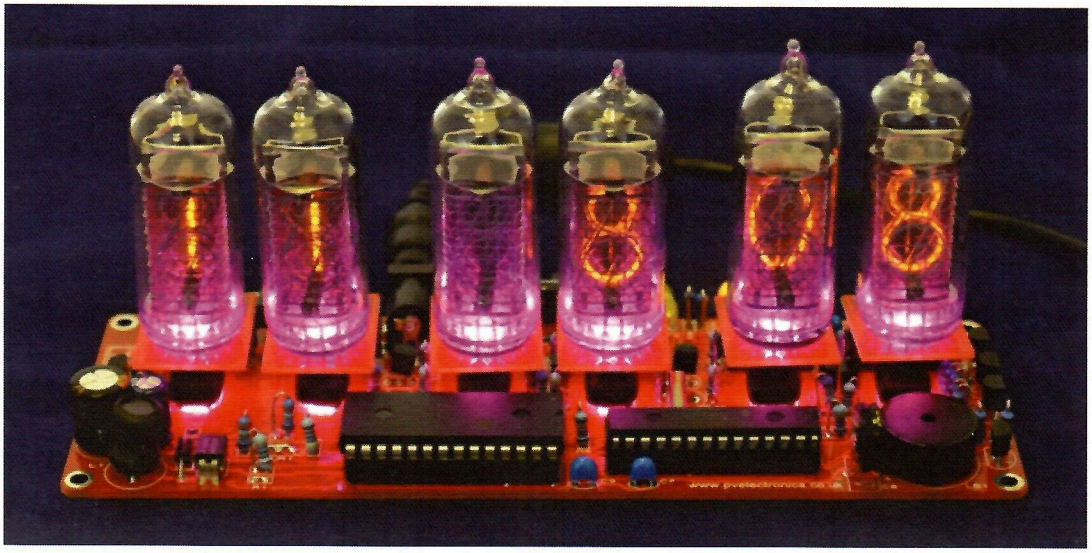
11.1 Entering RGB LED menu

Press and hold the 'DST' button until the display shows: 00: 0:00.
NX3 will not be lit.



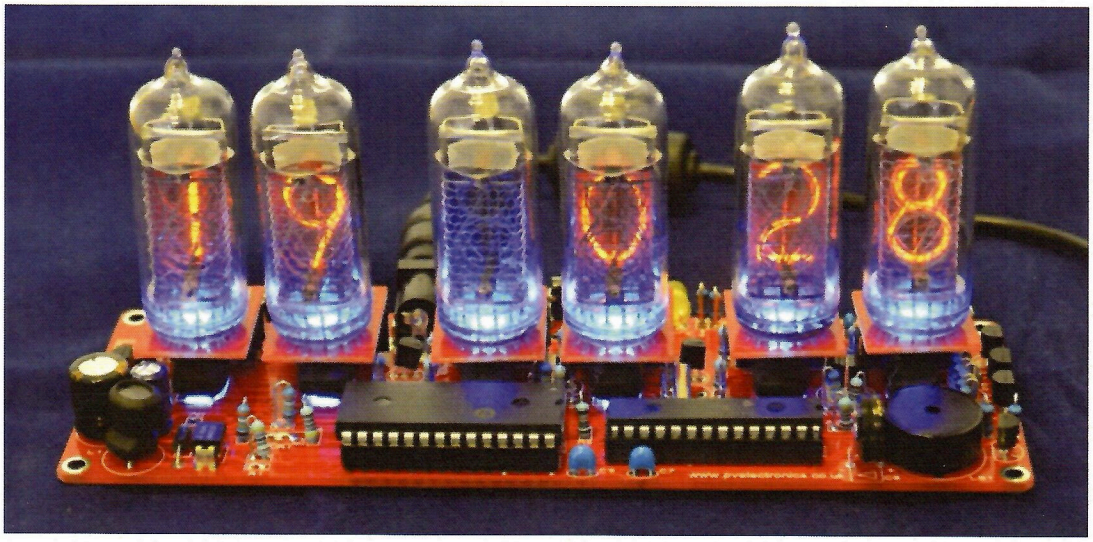
- For each hour (0-23), you can set a custom colour
- Each custom colour can have your choice of RED, GREEN and BLUE values from 0 (colour off) to 8 (maximum brightness)
- Mix the colours using the SET, ADJ, ALARM buttons.
- Use low values (1,2 and 3) for low brightness, eg. For night time
- Set the value to '0' for that colour to be off
- Once you are happy with the colour for that hour, press 'DST' to move to the next hour
- Have fun playing with your favourite colours and intensities!

- Colours are displayed live during RGB menu:



- In the example above, between 11 and 12 hours, the LEDs will be purple (8 red, 0 green and 8 blue)

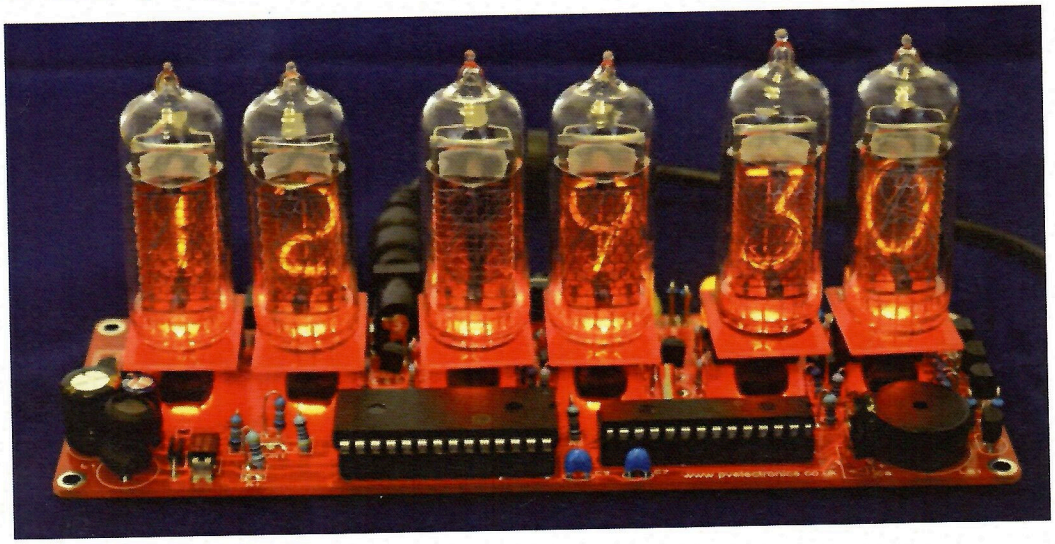
- In the example below, between 19 and 20 hours, the LEDs will be blue with a hint of green (0 red, 2 green and 8 blue)



11.2 Setting auto colour cycling

Setting colour RED to value 9 has a special meaning:
This will enable auto colour cycling for the specified hour. The speed of the cycling will then be governed by the GREEN value:
0 = very slow change
9 = very fast change

This auto colour cycling mode is explained in the picture below:



Red = 9, therefore Auto Colour Cycling is enabled for 12-13 hours
Green = 3, so speed is 3.
Blue value has no effect.

Note: The colours do not cycle live during Auto Colour Cycling setup. The cycling starts only during normal time and date display.

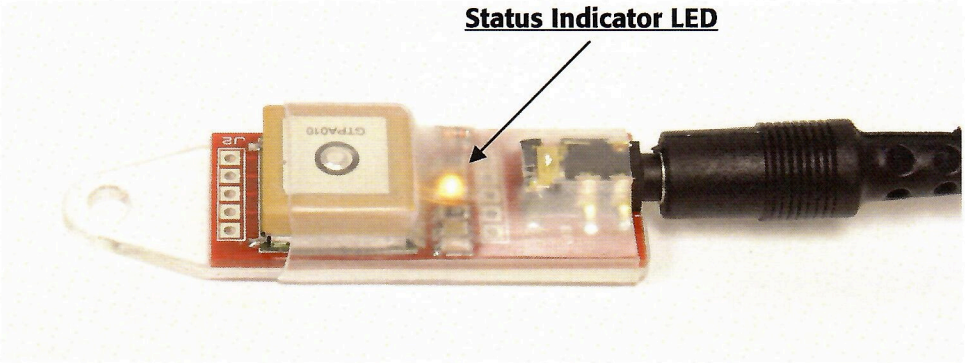
12. Using the Optional GPS Time Receiver

12.1 Configuring for GPS Synchronisation.

Set parameter 12 to value 1.
If using our GPS receiver, GPS baud rate in parameter (13) is already pre-configured.
Set parameters 14 and 15 for the hours and minutes your time zone is offset from the synchronisation source. This is usually only whole hours. Examples:
Eastern USA is 5 hours offset from UTC transmitted by the GPS
Set parameter (16) to identify whether the offset is minus (0) or positive (1) of the time source.

12.2 Connecting a GPS receiver

The clock has been designed for, and tested with our Micro GPS Receiver (Sold separately)



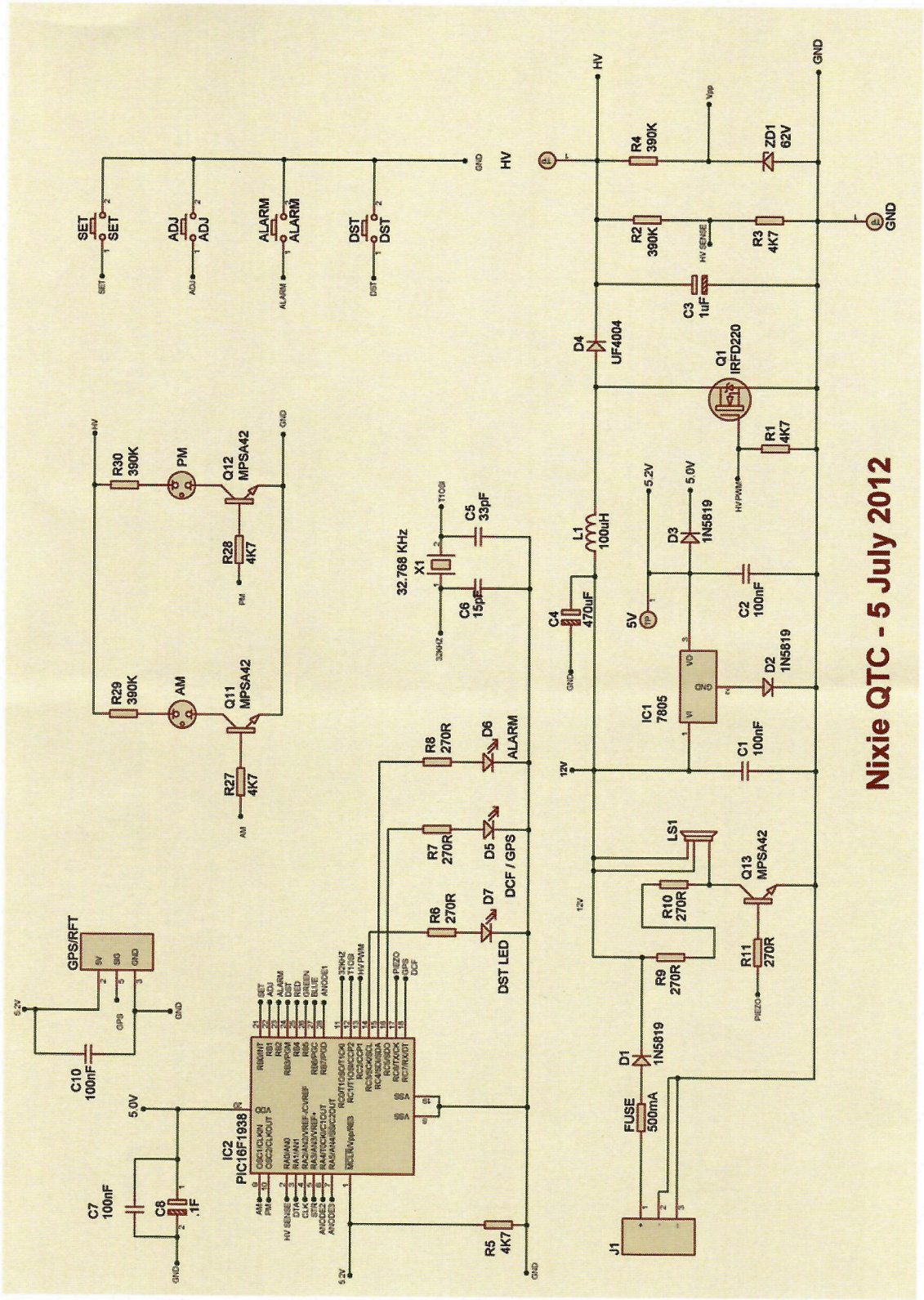
12.3 Function of the GPS indicator LED (D7):

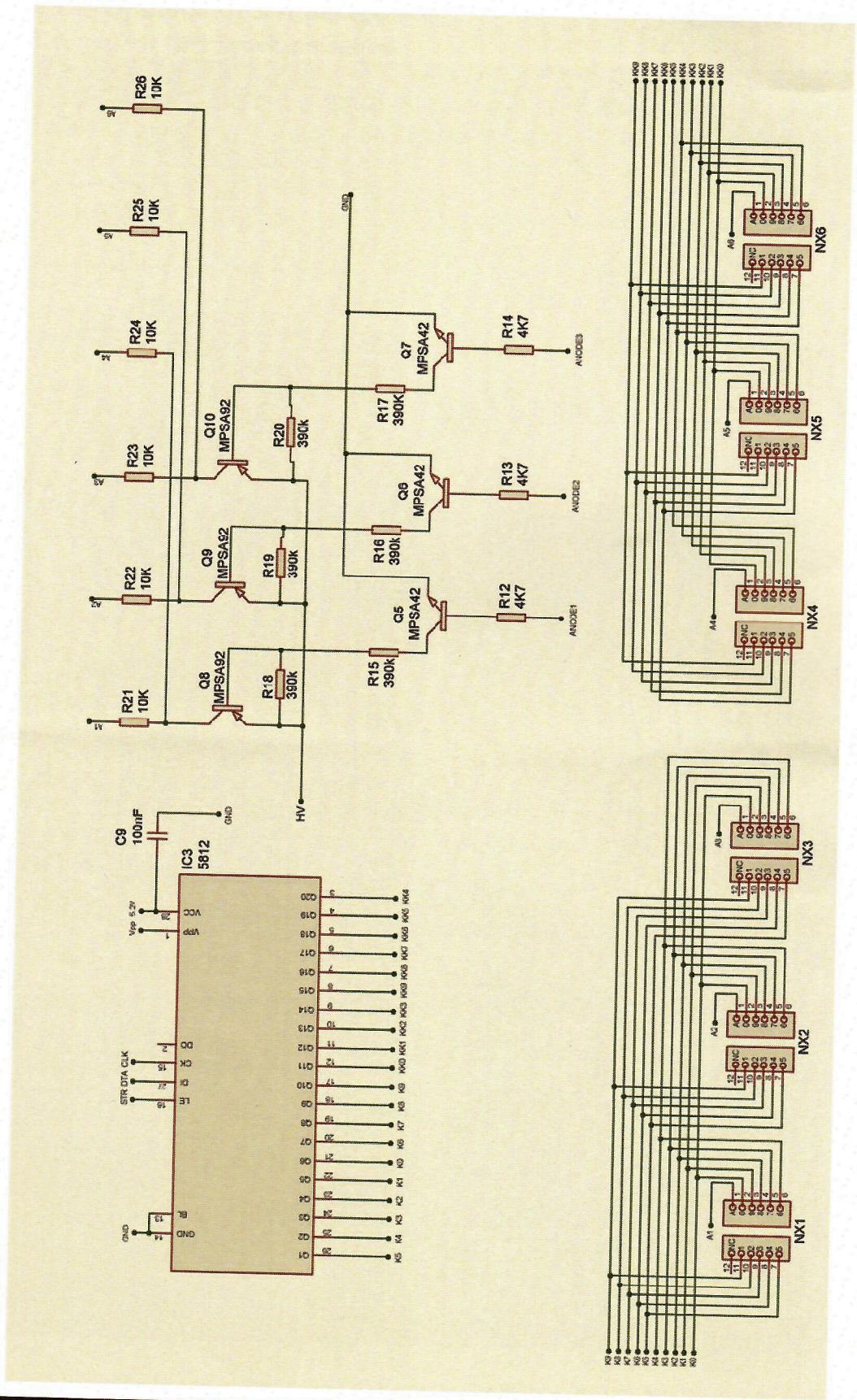
If GPS Synchronisation enabled (parameter (12) = 1)
The LED will be ON if the clock has synchronised in the last two hours; slowly flashing if the last synchronisation was between 2 hours and 24 hours ago; and off if the last synchronisation is older than 24 hours.

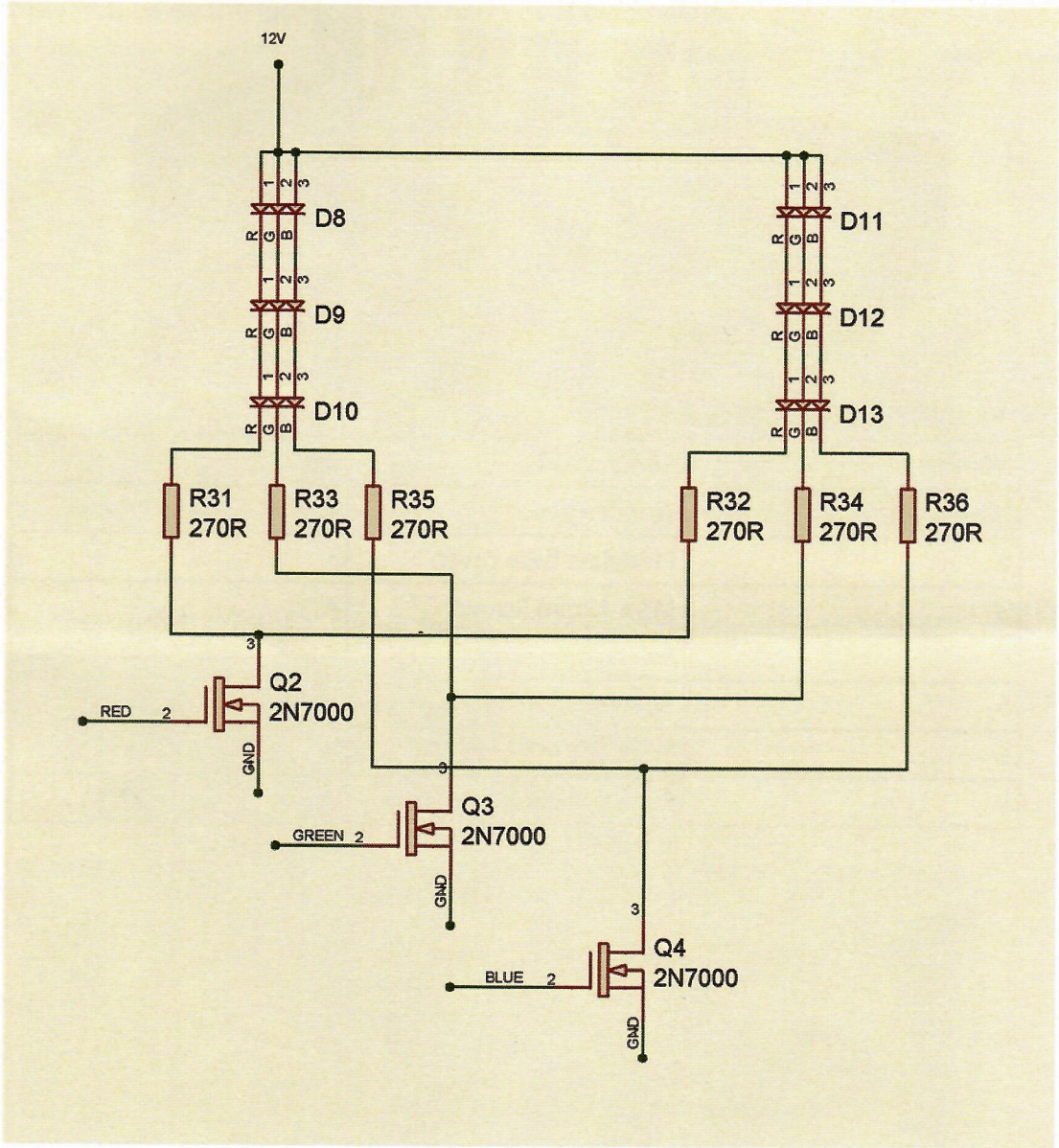
The function of the indicator LED may be summarised in the table below:

Radio Time Source	Sync < 2 Hrs	Sync >2 Hrs Sync < 24 Hrs	Sync > 24 Hrs
GPS	On	Slow Flash	Off

13. Circuit Diagrams




R26 10K
R25 10K
R24 10K
R23 10K
R22 10K
R21 10K
Q10 MPSA92
Q9 MPSA92
Q8 MPSA92
R20 390k
R19 390k
R18 390k
Q7 MPSA42
Q6 MPSA42
Q5 MPSA42
R17 390K
R16 390k
R15 390k
R14 4K7
R13 4K7
R12 4K7
ANODE3
ANODE2
ANODE1
GND
HV
C9 100nF
IC3 5812
Vpp 5.2V
VCC
VPP
STR DTA CLK
GND
NX6
NX5
NX4
NX3
NX2
NX1


12V
D8
D9
D10
D11
D12
D13
R31 270R
R33 270R
R35 270R
R32 270R
R34 270R
R36 270R
Q2 2N7000
Q3 2N7000
Q4 2N7000
RED
GREEN
BLUE
GND

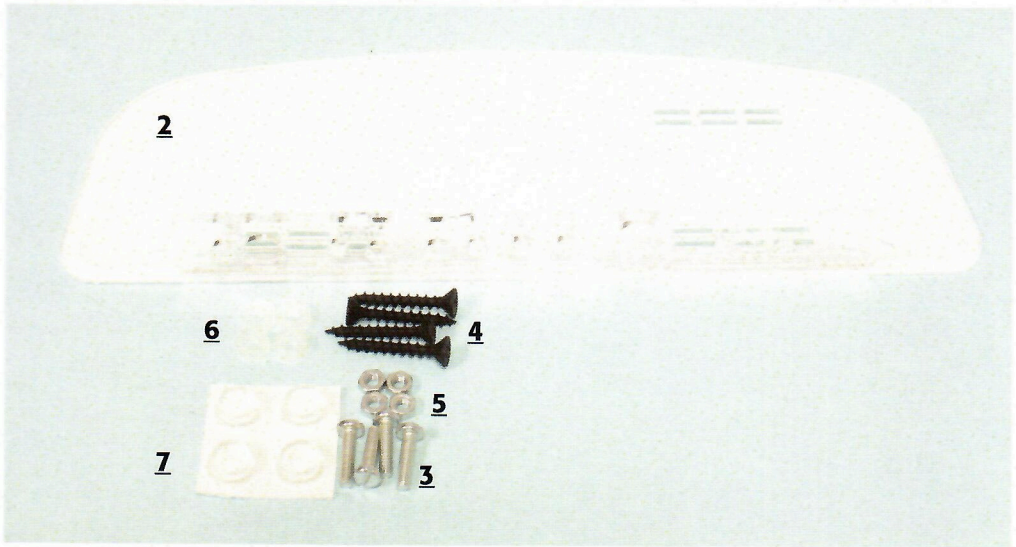
13. Case Assembly

Please see the appropriate subsection for instructions on installing your assembled board into its display case.

13.1 Teak Maple Hardwood Case

13.1.2 Verify/Identify Package Contents

Number	Component	Qty
n/a	Wooden Case	1
2	Plexiglass base cover	1
3	M3 x 12mm Screws	4
4	Self tapping screws	4
5	M3 nut	4
6	2mm plastc spacer	4
7	Polyurethane rubber foot	4



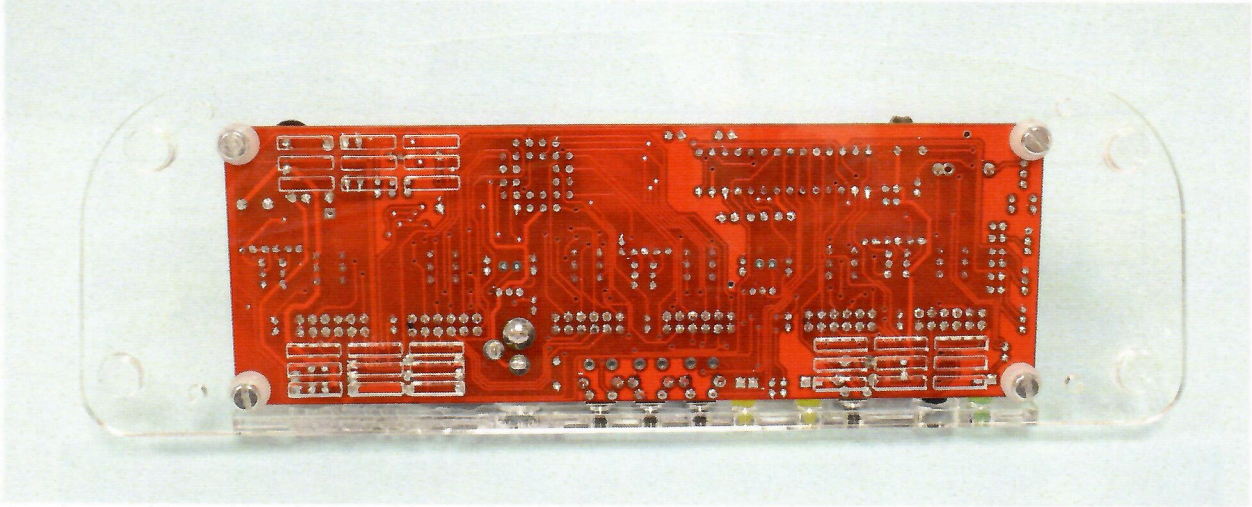
13.1.3 Assembly

1. Prepare the PCB

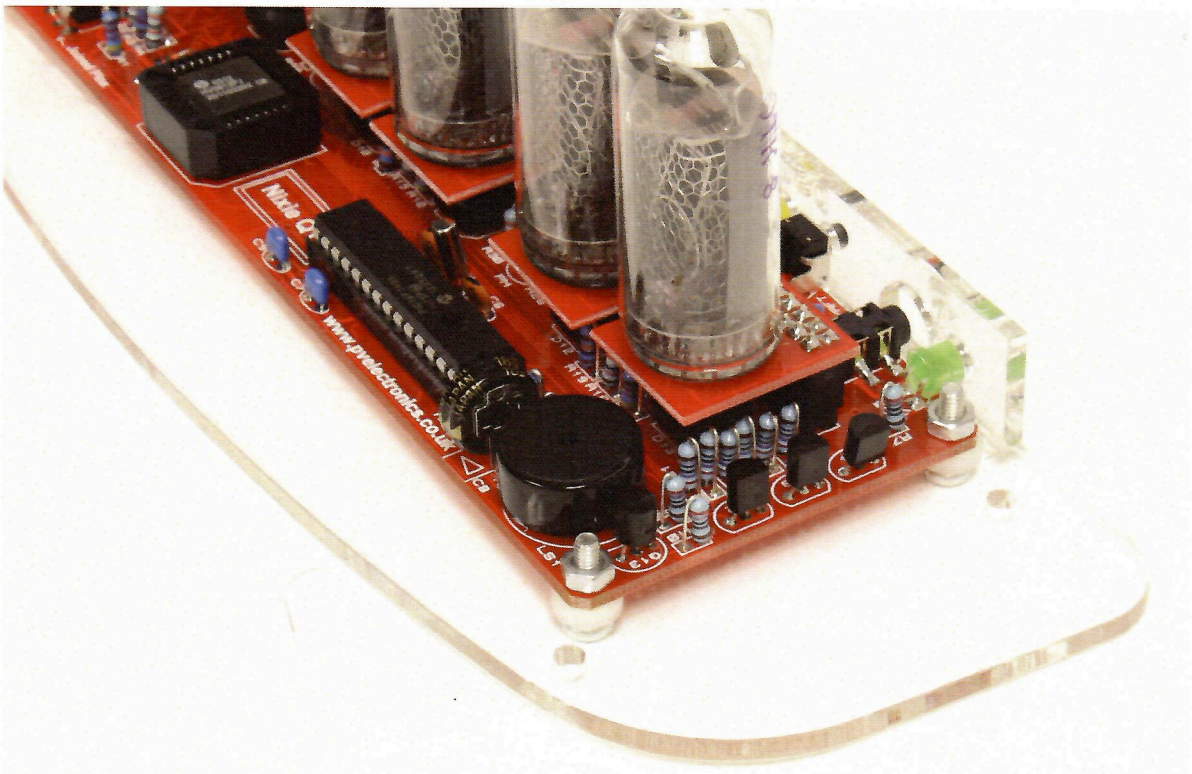
Ensure that the non-tube side of the PCB has all the component leads trimmed as short as possible, and in all cases less than 2mm.

2. Mount the PCB on the Plexiglass Base

Mount the PCB using the four mounting holes as shown below:



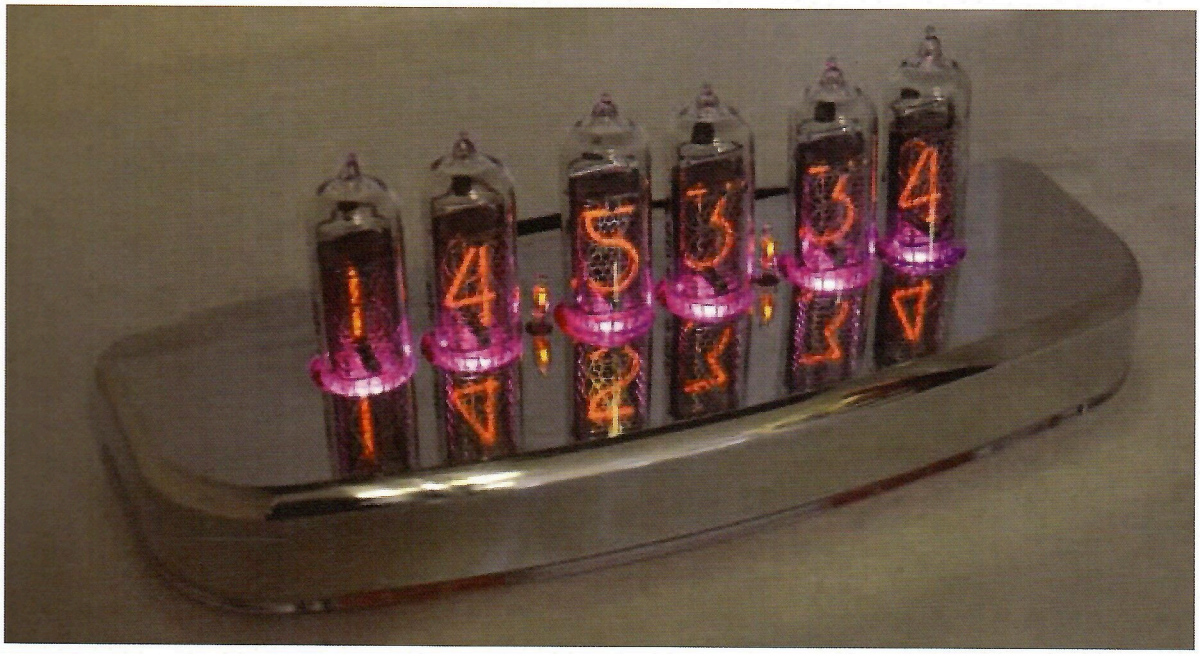
At each corner attach the M3 X 12mm screw, M3 nut and the 4mm metal spacer.



3. Mounting the Case

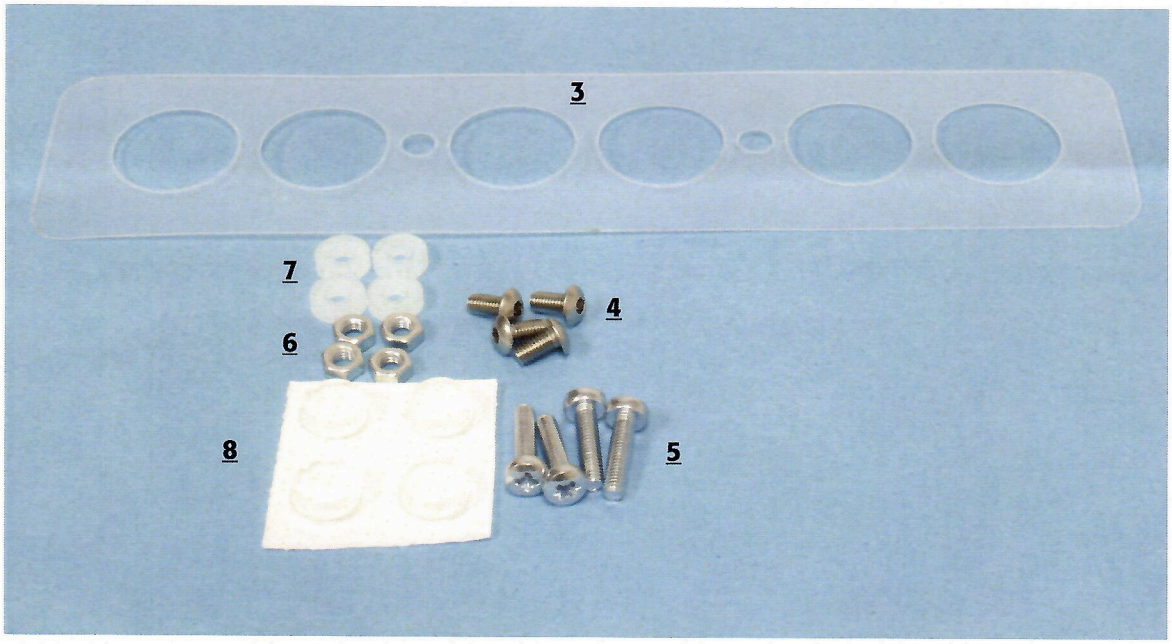
Carefully insert the PCB/base assembly into the wooden case. Use the four self tapping screws to secure the base to the case. Finally place the four polyurethane rubber feet, as shown below:

13.2 Aluminum Case



13.2.1 Verify/Identify Package Contents

Number	Component	Qty
n/a	Aluminum Case	1
n/a	Plexiglass base cover	1
3	Insulating spacer	1
4	M3 x 6mm Screw	4
5	M3 x 12mm Screw	4
6	M3 nut	4
7	2mm plastic spacer	4
8	Polyurethane rubber foot	4



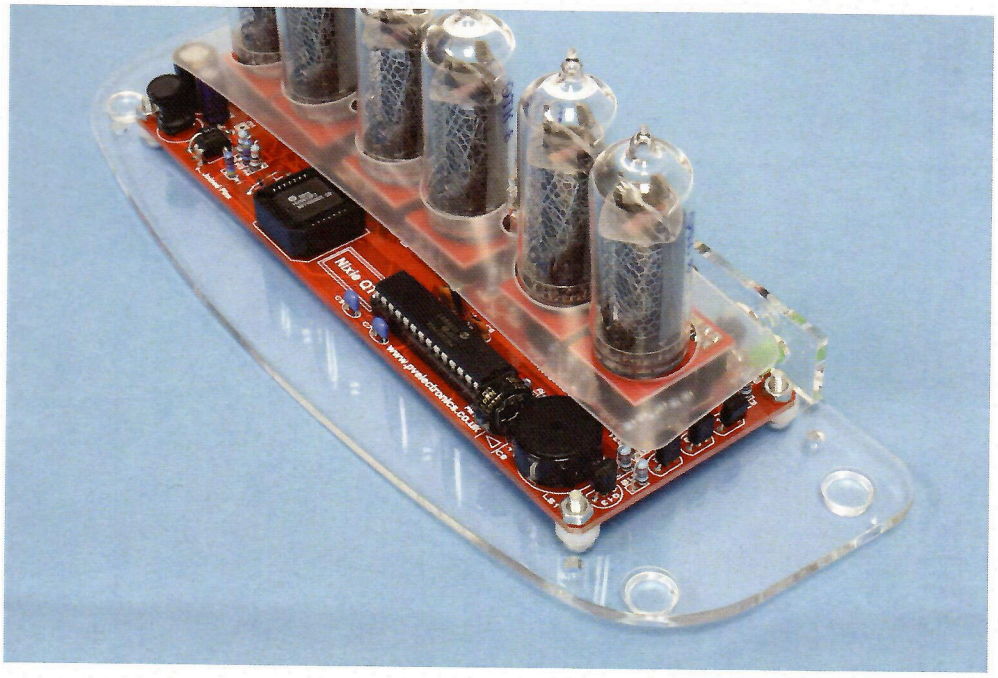
13.2.2 Assembly

1. Prepare the PCB

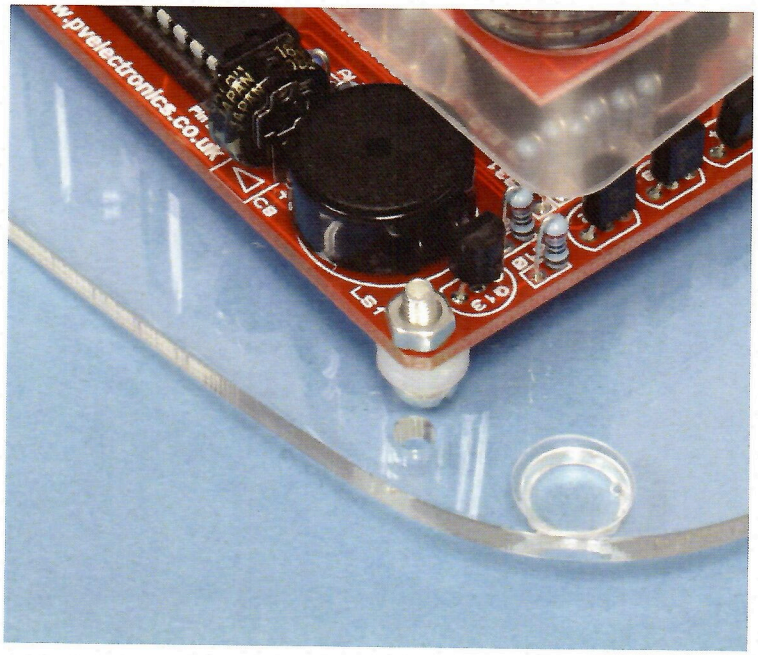
Ensure that the non-tube side of the PCB has all the component leads trimmed as short as possible, and in all cases less than 2mm.

2. Mount the PCB on the Plexiglass Base

Mount the PCB using the four mounting holes as shown below:

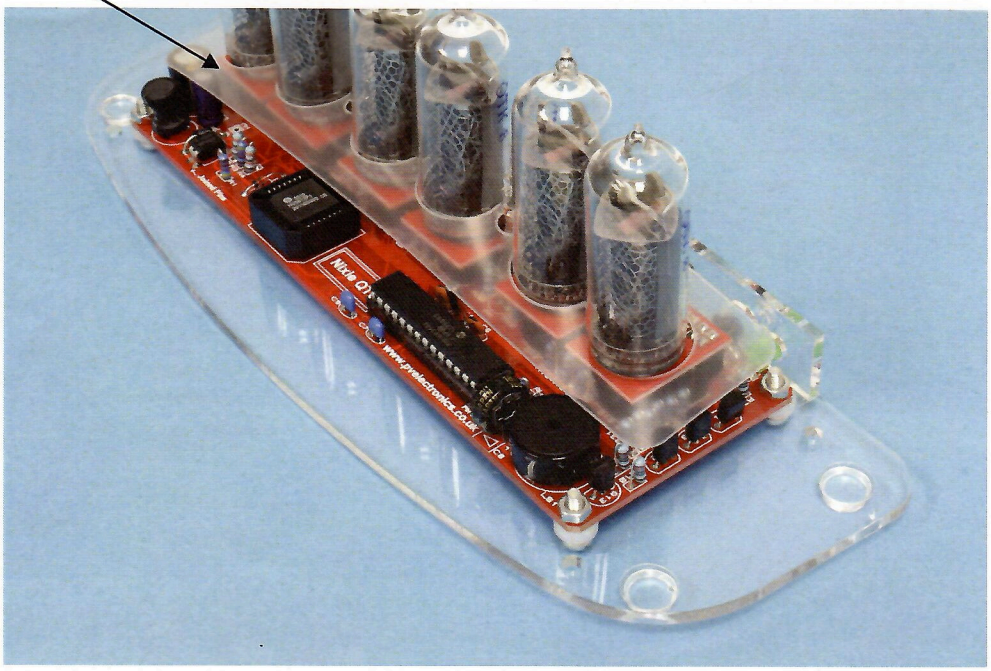


At each corner attach the M3 X 12mm screw, M3 nut and the 2mm plastic spacer.



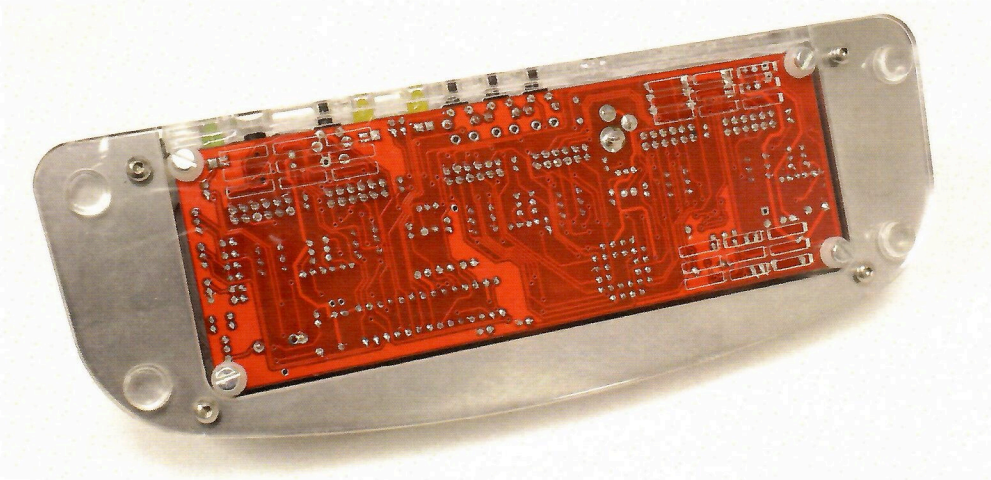
3. Attach the Insulating Spacer

Slide the spacer over the tubes as shown below:

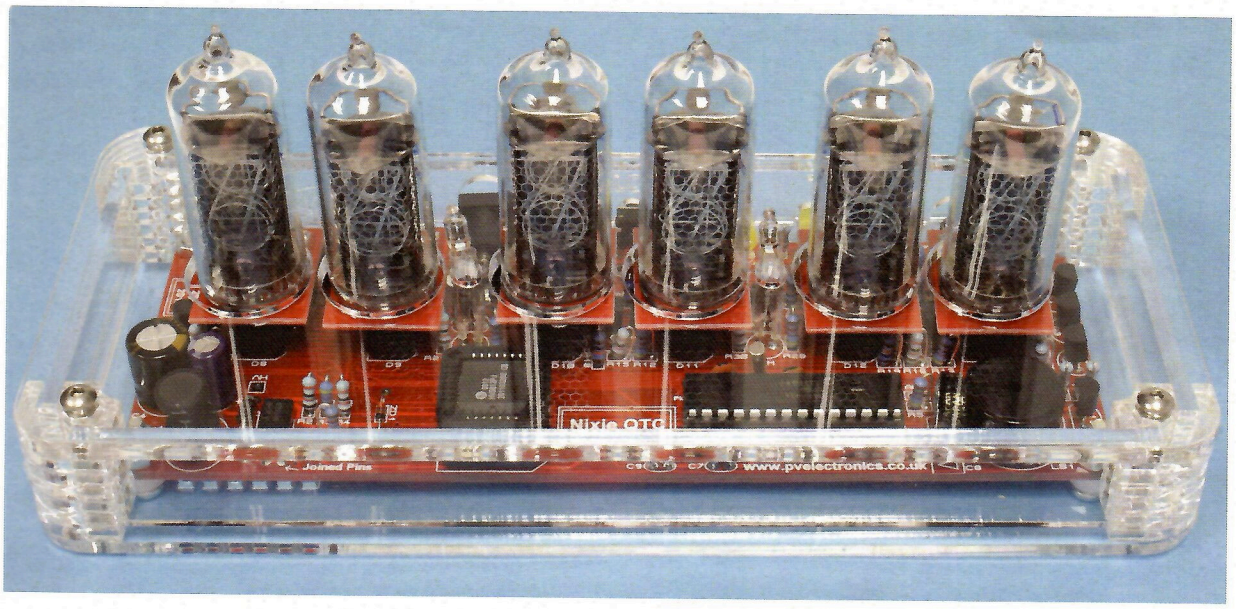


4. Mounting the Case

Carefully insert the PCB/base assembly into the aluminum case. Use four M3 X 6mm screws to secure the base to the case. Finally place the four polyurethane rubber feet, as shown below:

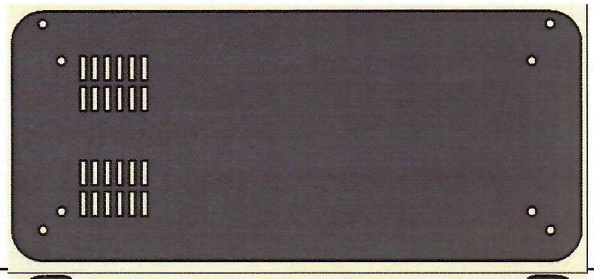
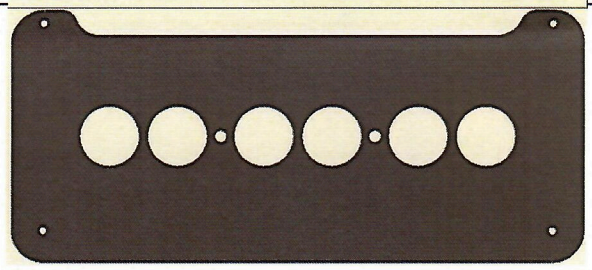
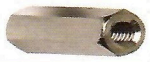


13.3 Plexiglass Case



13.3.1 Verify/Identify Package Contents

Use the table on the next page to locate each component.

Component	Qty	Image
Front connector	12	
Rear connector	12	
Case side	2	
Case front	1	
Case back	1	
Case base	1	
Case top	1	
M3 X 6mm screw	8	Not pictured
M3 X 18mm hex threaded spacer	4	
M3 X 12mm screw	4	Not pictured
M3 nut	4	Not pictured
2mm spacer	4	Not pictured
Polyurethane rubber feet	4	

13.3.2 Assembly

1. Prepare the PCB

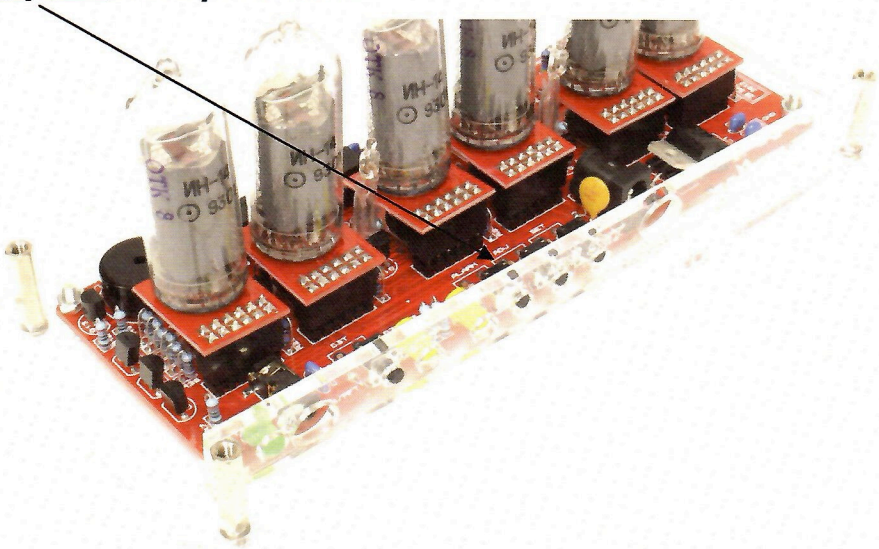
Ensure that the non-tube side of the PCB has all the component leads trimmed as short as possible, and in all cases less than 2mm.

2. Mount the PCB on the Plexiglass Base

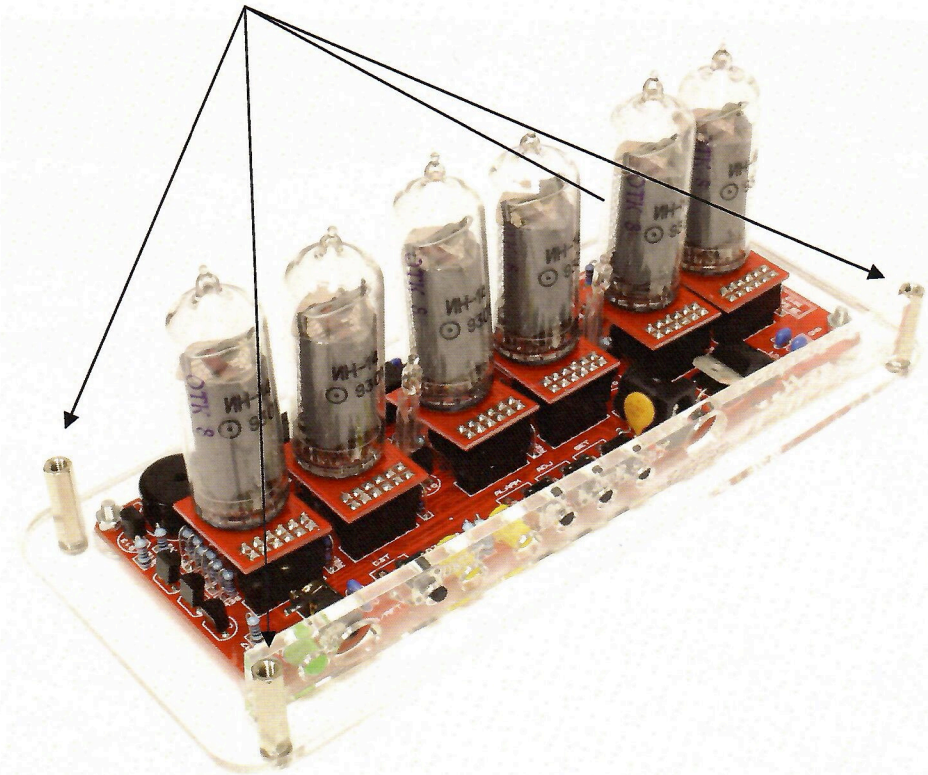
Mount the PCB using the four mounting holes.

At each corner attach the M3 X 12mm screw, M3 nut and the 2mm plastic spacer.

3. **Put the back panel Loosely Into Place**



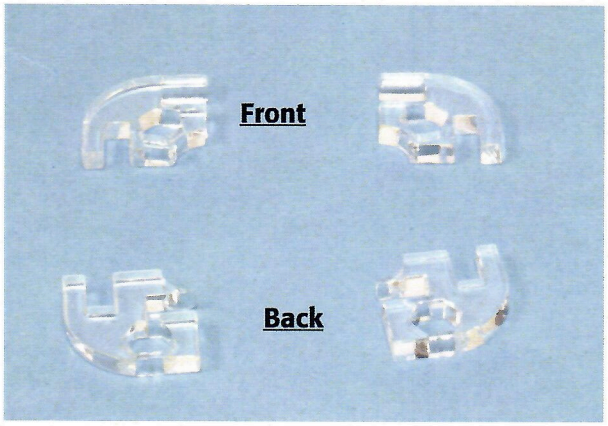
4. **Mount the 18mm hex spacers on the Base of the Case**



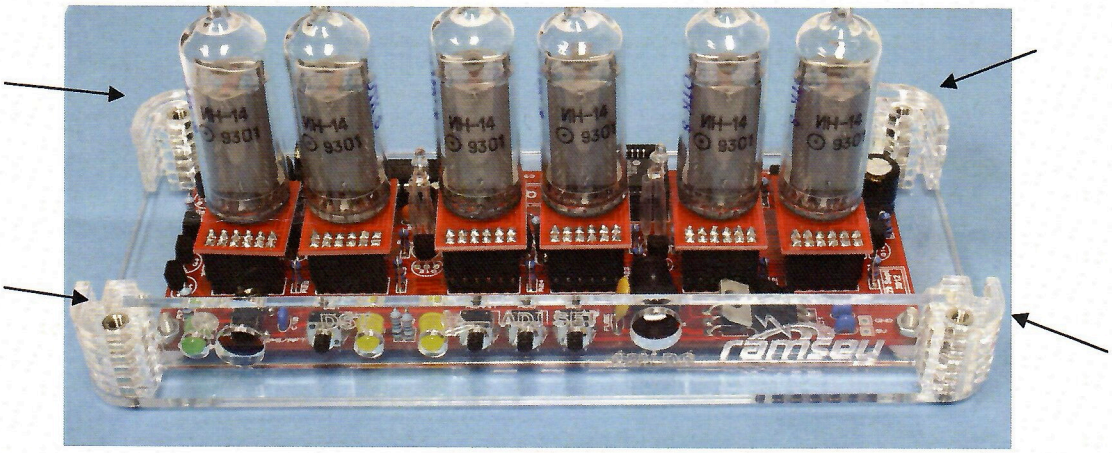
5. **Mount the components onto the base. Do this for all four base mounting holes, leaving the screws finger tight.**

5. Identify the front and back connectors

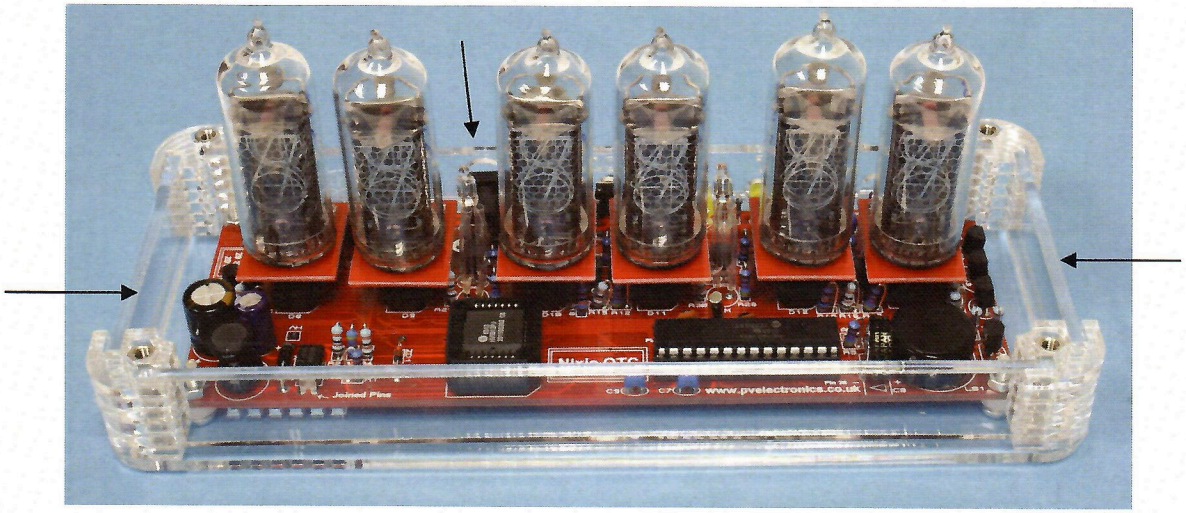
Note the different shape of the front and back connectors. Ensure any protective film has been removed:



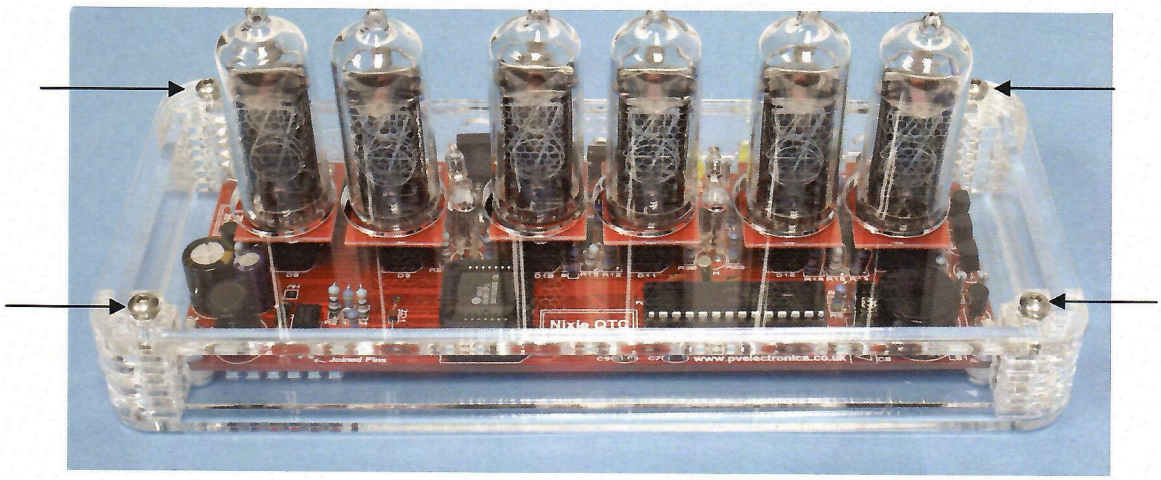
6. Slide six rear connectors over each of the two rear hex spacers and six front connectors over each of the two front hex spacers.



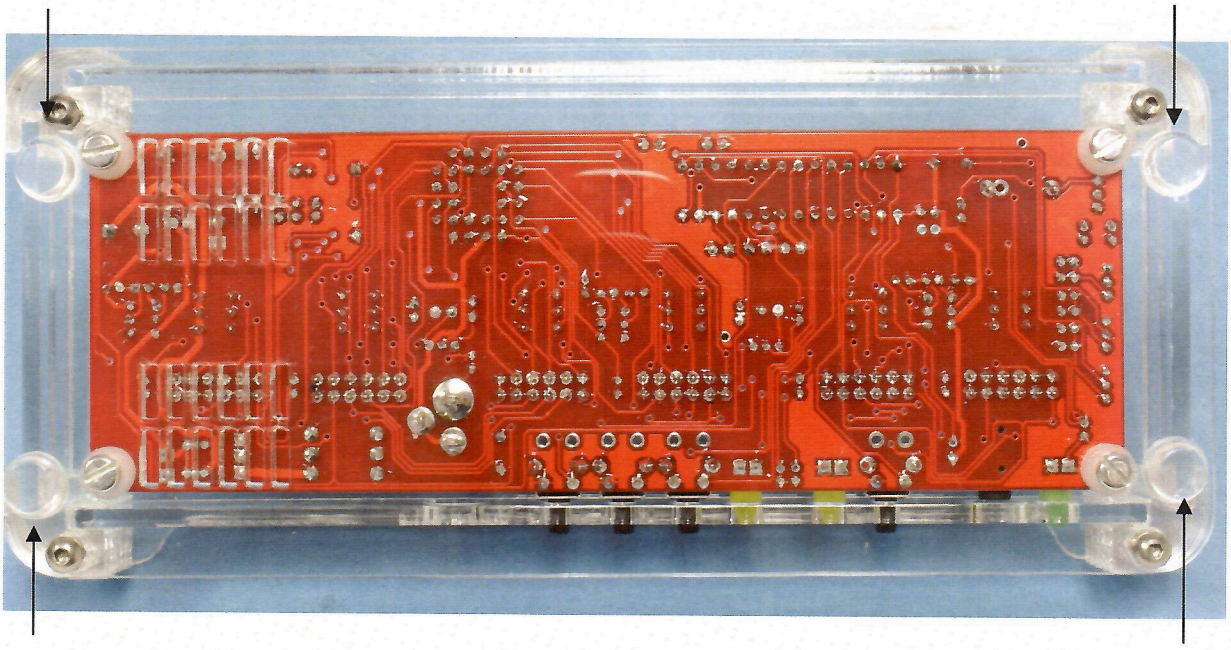
6. Slide the front and both side panels into place as shown below:



Place on the top cover and secure with the remaining M3 X 6mm screws. You can now gently tighten the four corresponding screws on the base of the case that were left finger tight in step 3.4



6. **Finally, place the four rubber feet as shown below:**



RAMSEY ELECTRONICS, LLC
590 Fishers Station Drive
Victor, NY 14564
(585) 924-4560
www.ramseykits.com

Nixie Clock Manual
November 2012
V1.1